# Africa RISING Phase I stories and evidence of contributions to Feed the Future aspirations

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/



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# Introduction

This document presents select stories of success from Africa RISING Phase I activities in the domains of gender, nutrition, climate change and natural resource management across all the 5 program focus countries over the past 5 years. It has been assembled by the Africa RISING communications team to illustrate various ways in which over the years, the 3 projects that make up the Africa RISING program have contributed to the aspirations of the US Government's Feed the Future Initiative. The publication is divided into four prinipal sections (per domain)with a list of further reading material on the four domains at the end of each section.

# Gender

Gender is a cross-cutting thematic area and it is integrated into all of Africa RISING's research and development interventions during phase I. This is done through gender mainstreaming into ongoing research interventions and through strategic gender research. Some of the key achivements during this perion includes:In line with this , Africa RISING undertook various activites which are covered in the following news:

## "I really like to plough, though I get tired afterwards" - Worknesh Gurmesa

*Worknesh explains how lack of access to the market keeps her potatoes in storage. Photo credit: ILRI\Simret Yasabu*

This is the story of Worknesh Gurmesa a farmer in Chelanko Kebele. I met her during our April 2013 field work to test the use of SLATE - a tool for Sustainable Livelihoods Asset Evaluation (more information). This training of trainers was jointly organised by Africa RISING and the Nile Basin Development Challenge. Participants were from the Africa RISING Ethiopia project sites and the NBDC Innovation Platforms.

This story is told as it explains the importance of women's inclusion and how access to markets affects as well as changes lives.

Like many other girls in rural Ethiopia, Worknesh married early. She was born and raised in a large family of ten and knows how hard it is to support a big family through subsistence farming. She had always thought of breaking this trend through education. However, this seemed only a dream: Although one of the top-ranked students in her class, she was not able to continue her schooling after grade 7. Nevertheless she persisted.

She had her first child one year after she got married. Giving a 2-3 year gap between children, she gave birth to 6 children (3 sons and 3 daughters). She went back to her dream of education. She began again with her schooling from grade 8 in 2007 and completed grade 10 in 2009, though not as high-scoring a before. *"It became difficult for me to study and raise children at the same time and I couldn't go further"*.

Her family earns a living from farming and dairying and Worknesh is an active farmer and household manager. She particularly involves herself during the planting and harvesting seasons: "*I really like to plough, though I get tired afterwards*", she says. She supervises the people who are paid to farm their land, she makes sure what is harvested is properly collected and stored and she manages the finances.

Today, the family is getting to be economically strong. It has 5 oxen, 2 cows, 4 horses,2 donkyes, 4 hens, 5 sheep, 2 lambs and large areas of farming as well as grazing land . They are now moving to a new house which has better access to facilities including electricity, water, mills and infrastructure like roads and the school.

She strongly believes in women's empowerment and economic strength. Towards this, she established three women associations, each with fifteen members. She is chairperson of one of them. The associations aim to improve the lives of their members through capacity building and market assessment. They also serve as problem-solving platforms and help members to develop self-confidence. The associations struggle as they are not able to get licenses to operate.

Worknesh says "women *are not always encouraged to move independently and that was why we found it very difficult to get the license for so long to move forward*". They need license to operate beyond their local areas. *"If we are lucky to get someone to buy and take our potatoes to Addis Ababa, we sell them for between 500 and 800 birr (1 USD ~ 19 birr) per quintal. However, this is not the case most of the time and we are forced to sell our potatoes to the nearby market for only 100 - 200 birr per quintal*". Moreover she adds "*there is much wastage as we are keeping the potatoes for a longer period when they are not sold*".

This year, with a smile in her face, their voices were heard and their licenses are ready to be issued. When they get the license they will have the right to go beyond and sell their outputs with good price and on time.

## Africa RISING Ethiopia project identifies gender 'champions'

Following the recent workshop on 'Integrating Gender into Agricultural Programming', the Africa RISING project in the Ethiopian Highlands has decided to engage 'gender champions' to raise gender awareness, cultivate gender equity and ensure sustainability of gender work in the project.

At least two gender champions have been selected in each of the 4 woredas where the project is working to ensure that gender differences are taken into account in each and every innovation platform (IP) activity. At least one of the gender champions serves on the IP as a technical committee member. The seven gender champions selected so far will drive the gender agenda within Africa RISING'S action sites.

They have been trained in gender and sensitized about the gender goals of the program. They will work closely with the project's gender scientist and IP facilitators to nurture gender within the IPs.

The criteria for selection of the champions included:

- Knowledge and interest in gender and committed to closing the gender gap
- Previous experience in working with men and women's groups
- Knowledge about Africa RISING's sites at woreda and kebele level
- Representative of partner institution working within Africa RISING's sites

### *Roles of the gender champions*

Gender champions will not be gender experts but will support Africa RISING scientists and IP facilitators to mainstream gender in program interventions and provide a deeper understanding of the local context surrounding gender in mixed farming systems. The gender champions will share the gender goals with community leaders and IP members, secure local buy-in for gender goals, persuade hesitant women and disadvantages men to join IPs and innovation clusters; create a suitable environmental for participation of men and women and address gender challenges as they arise during the course of the interventions.

Some of their specific roles will include:

- Actively participate in innovation platform activities at woreda and Kebele level
- Ensure that women are represented in IP activities and that they participate actively
- Ensure that women are represented in leadership committees
- Actively participate in data collection and report writing
- Input to knowledge products
- Share relevant resources
- Work closely with male actors who are committed and influential in community development initiatives such as male community leaders to drive change in gender constraining norms and attitudes
- Identify areas that need attention to ensure that research interventions benefit both men and women farmers
- Participation in gender championing is primarily on a voluntary basis.

## Does gender matter for Africa RISING?


*Cleo Roberts. Photo credit: IITA/Jeffrey Oliver*

*In this interview, Cleo Roberts (senior research assistant and monitoring and evaluation officer at the International Food Policy Research Institute - IFPRI) explains why gender is an important component for Africa RISING projects.*

**Why is gender important for inclusion into Africa RISING projects?**
It is important if we want to increase food production and improve nutrition and increase welfare for households. It will also ensure that we put interventions into the hands of those who will want to use/apply it therefore ensuring that we have direct impact on aspects of household life. For example if an intervention aims at improving household nutrition, but it doesn't include the people who typically cook in households who are women, then we are less likely to achieve the desired impact of the intervention. Gender therefore basically takes into account the roles different people play within the households to ensure better results at the household level.

**Is gender only about women?**
No. When we are working on interventions that could be very useful in the hands of women, it could be easier to look at men as the barriers to interventions even though this is not the case. Usually the barriers are caused by social norms rather than men, hence the "over simplified" assumption that gender is only about women. But there are plenty of ways in which we can think about men and gender, too! So gender is actually both male and female and beyond. Gender helps us know who is benefiting and how.

**How will inclusion of gender aspects help Africa RISING achieve its sustainable and intensification goals?**
Of course, inclusion of gender in certain interventions will definitely ensure sustainability beyond Africa RISING projects. Again, for example an intervention focusing on improving household nutrition that considers gender roles in a home and involves the person who mostly prepares meals in a home (mostly women) will definitely ensure sustainability especially with the right buy-in.

**What are some of the challenges you faced in the course of implementing the surveys generally and with regards to gender?**
One of the more general challenges we faced initially was figuring out who the beneficiaries of the Africa RISING projects were. That is a fundamental aspect that we needed to establish before we could go ahead with any M&E work. With regards to gender, the main challenge was conducting cross-gender interviews, and this was across all the countries. In one of the countries the female enumerators also ended up having to cook for the teams which could have negatively affected their work.

**What were some of the strategies you applied to maintain the integrity of the data you collected?**
It is sometimes very useful to focus explicitly on gender in the questionnaires. However, most of the respondents by now know or have generic and "politically-correct" responses that they will give once they realize that you are interested in gender aspects. So in our surveys we tried to weave individual gender questions with the household ones. For example, a question like which person decides what to feed the household doesn't make a respondent feel like the questions are a criticism of their lifestyles.

***Read Cleo Roberts's Africa RISING staff profile** here**.***
*Find out about more gender work across Africa RISING*.

## Africa RISING Ethiopia studies factors enhancing or hindering women farmers' participation in agricultural research

*A female researcher interviewing a female farmer. Photo credit: ILRI\Annet Mulema*

In Ethiopia, the number of women engaged in agriculture is increasing as more men withdraw from farming.

Although women play a central role in agriculture and family well-being, their roles remains invisible. Women farmers' participation in agricultural research and extension is still very low.

Further, researchers in Africa RISING have observed low participation by women in the innovation platforms and research groups that are at the heart of the project in Ethiopia. Low participation by women has implications on the type of decisions made and how they impact on the less represented groups. Low participation of women in research groups also has implications on the adoption of the technologies experimented with and benefit sharing amongst men and women.

To address these issues, Africa RISING recently carried out a study to identify the underlying factors that enhance or hinder women farmers' participation in agricultural research and extension activities in Ethiopia to ensure that they benefit equitably.

The study aims to: a) describe the demographic and socio-economic characteristics of women participating in Africa RISING's research and non-participants, b) determine the level of participation of women in Africa RISING research activities; c) determine the socio-economic and institutional factors influencing women's level of participation in Africa RISING's research activities.

The study was conducted between March and June 2015 in the four action sites. Focus group discussions were held with men and women farmers to document their perceptions about the factors that enhance or constrain men and women farmers' participation in research and extension activities.

In each action site, four separate focus group discussions were conducted with men and women participating or not participating in Africa RISING's research and extension activities.

To further understand and quantify the level of women participation and the influencing factors, a survey was conducted with women farmers only including women participating in Africa RISING's research and non-participants. At least 30 women farmers in each category participated in the survey.

The data are still under analysis and the results will be shared in different forms. However, preliminarily results from Lemo reveal that women's work load, their position in households, level of decision making power, culture/traditions, access to information, process of selection to participate, being a model farmer, access to and control over resources, and kinship links to to kebele leaders could explain their level of participation in agricultural research and extension interventions.

## RISING voices: Gundula Fischer, Africa RISING Gender Specialist (IITA)

*Gundula Fischer, is the Africa RISING Gender Specialist at the International Institute of Tropical Agriculture (IITA). She introduces herself and her work within the Africa RISING program. This is one of a series of portraits of key people in Africa RISING.*

**Tell us about your background***?*
From my early days, I developed a great interest in the dynamics of society and culture. So, I pursued an MA degree in Social Anthropology from Ludwigs-Maximilians-University in Munich, Germany. Later I did my PhD studies at Bayreuth University, Germany. A partnership with the University of Dar es Salaam enabled me to do my fieldwork in Tanzania. My PhD thesis investigated how kinship impacts on the access to resources and the division of labour in a work setting. My later specialization in gender was but a shift to another criterion that works in similar ways: Gender often relates to the control over resources, to the type of work we do and the labour burden we have, to the way benefits are shared within the household.

**What were you doing before joining Africa RISING?**
Before I joined Africa RISING, I lectured for two private Tanzanian universities and supported them in the establishment of Master's programs in sociology and anthropology. In addition, I served as the research coordinator of a European Union funded development project in Tanzania's Southern Highlands.

**What do you do in your current position within the project?**
I have multiple assignments. One of them is to support my colleagues (the biophysicists and economists working in the project) to integrate more gender aspects in their work with the target groups. Apart from that, I conduct qualitative studies with a focus on gender. But I am also in charge of a gender capacity assessment (we are currently carrying out) and of gender action planning. These are just some of my activities.

**What are your early impressions of gender within Africa RISING?**
When I talk to my colleagues in the project I often get interesting information about gender. Many make observations in the field. What would be important now is to develop a more systematic approach to collecting gender-disaggregated data and to perform gender analysis based on these data.

**What does it mean when somebody says a project has fully integrated gender? What is the ideal benchmark?**

Gender mainstreaming is like a two-headed arrow with one head pointing in the direction of the target group and the other head pointing towards the organization implementing the activities. On the one hand, it is important to understand more of the gender dynamics in our target groups, for instance how do our technologies interact with intra-household gender dynamics in our action sites. That is part of gender analysis. On the other hand, there is the second direction of gender mainstreaming which leads us to reflect on our own organization. How are we dealing with gender issues within our own project? What about our internal policies and arrangements? What about our organizational culture? Gender is fully integrated, when we are deliberately working towards both directions.

**How do you see current gender activities with regard to a possible second phase of the project?**

*I think we are at a stage where we can prepare very well for the possible second phase. For instance, the gender capacity assessment will give us a baseline of the training needs and how to address them. Moreover, we have agreed that we will emphasize gender analysis in the research outputs "situation analysis" and "systems improvement". This will strengthen the gender foundation for the next phase.*

**Do you foresee any potential challenges in terms of data collection together with the biophysical scientists?**

Of course, biophysicists, quantitative economists and qualitative anthropologists adhere to different paradigms in the sciences. However, a dialogue across boundaries can be very fruitful and is especially important in a systems approach. There is always room for learning from both sides as long as both groups keep an open mind.

## RISING voices: Annet Mulema, gender specialist at the International Livestock Research Institute (ILRI) in Ethiopia

*Annet Mulema, gender specialist at the International Livestock Research Institute (ILRI), introduces herself and her work with the program. It is one of a series of portraits of key people in Africa RISING.*

**Tell us about your background**

I have a Bachelor's Degree in Agriculture awarded by Makerere University, in Kampala, a master's degree in Management of Agro-ecological knowledge and socio-technical Change awarded by Wageningen University in the Netherlands and a Ph.D. in Sociology and Sustainable Agriculture awarded by Iowa State University, in the USA. My first job was at the International Center for Tropical Agriculture (CIAT) in Kampala where I worked as a research associate, supporting research in the 'Enabling Rural Innovation' project, and the sub-Saharan Africa Challenge program. After my PhD. I worked for Practical Action in Nairobi, coordinating a regional study on the impact of climate change, then joined the Africa Capacity Building Foundation (ACBF) as a knowledge management expert where I coordinated the institution's senior policy makers' knowledge sharing program. It is from there that I joined the International Livestock Research Institute in Addis Ababa, Ethiopia, were I am currently working as gender specialist. Shortly after joining ILRI, I was selected as one of the 2014 AWARD fellows, a career development program for impressive, talented and motivated female scientists in agricultural research.

**What do you do in your current position?**

In my current position as a gender specialist, my job is to support ILRI's programs and projects to integrate gender into crop-livestock research. I support two CGIAR research programs: *Livestock and Fish* and *Humidtropics;* two bilateral projects:cAfrica Research in Sustainable Intensification for the Next Generation (Africa RISING), a USAID- funded project, and an IFAD project addressing animal health. My major role is to implement the gender strategies for the respective programs and projects. I use the gender lens to ensure that programs do not miss vital gender roles and differences in the ownership and control over productive resources that affect family nutrition, income, food security, and vulnerability. I am involved in gender responsive research, identifying approaches to increase womens' participation in crop and livestock value chains, as well as increasing their access to and control over productive resources and benefits. Besides this I also enhance the gender capacity of ILRI's staff and partners in diagnosing and overcoming gender based constraints. Insights into the work I do in Africa RISING can be accessed at http://africa-rising.wikispaces.com/Gender+in+Africa+RISING

**What are your plans for Africa RISING?**

From the gender responsive studies that I have conducted so far, I have noticed that one of the major constraints to women's access to and control over productive resources and benefits from our research is culture and norms. Culture and norms have in part contributed to male dominance especially in Ethiopia. Therefore, a plan to address this is to introduce gender transformative approaches in the sites where I work across the program/projects that I support. I would like to employ the household transformative approach as an effort geared towards empowering women. The approach transforms gender constraining norms and relations. I would also like to undertake a study to understand the impact of our interventions (including technologies and institutional innovations) on men and women farmers that we work with and also understand the extent to which the gender capacity development initiative has impacted on the way our partners do their work. I would like to have more youth involved in the research and benefiting directing from ILRI's research.

From the gender responsive studies that I have conducted so far, I have noticed that one of the major constraints to women's access to and control over productive resources and benefits from our research is culture and norms. Culture and norms have in part contributed to male dominance especially in Ethiopia. Therefore, a plan to address this is to introduce gender transformative approaches in the sites where I work across the program/projects that I support.

**What are the biggest Africa RISING challenges and how do we deal with them?**

One of the biggest challenges is getting people to integrate gender in their work. Although many of us express commitment to gender, many of us do not actually do it. Many of my colleagues think it's the work of the gender expert. In addition, many of them do not consult me. So you see all these reports that are published and they are completely gender blind. This really frustrates me and I keep wondering whether I am doing my best. But I work with people and not plants that I can control. Dealing with this challenge requires commitment and support from top management. Top management has to give orders. We also need to specify areas where we need to do well on gender…areas were gender should not be overlooked.

The other challenge especially in Ethiopia is getting women to participate in our interventions. This is attributed to, in part, the culture and norms within the communities but also the commitment and capacities of our staff and partners. So I would like to conduct another gender capacity assessment (follow-up assessment) and try out different approaches of gender capacity development. Instead of doing trainings only, I want to complement it with coaching and mentoring. I want to compile a tool kit with all the gender analysis tools for the staff and partners to use. This tool kit will include gender transformative approaches. Most of our partners lack access to gender analysis tools, so this will come in handy.

**What are some of the main achievements of this program?**

Africa RISING Ethiopia has a gender strategy which we are implementing. I think it requires some revision. The strategy has guidelines to mainstream gender but I guess very few if any, have read this strategy, internalized it and tried to enforce it. We also have gender champions on the ground who support the field-based teams in conducting gender-related activities and giving

feedback from the research we do. The communications team has also done a great job of publishing the work we do in different forms to accommodate different audiences. Africa RISING-Ethiopia has also been successful in gaining a pool of competent partners to support different kinds of research that address the Feed The Future outcome indicators.

**What gives you hope looking at a possible second phase, based on the first phase?**
Africa RISING is contributing to most of the feed the future outcome indicators including gender and nutrition, which are labelled as cross-cutting issues. Gender is at the heart of Africa RISING research. We are doing quite well on addressing the root causes of gender disparities. More is needed to close the gender gap so we need more funding to implement interventions that will bring about positive change in the livelihood of the rural poor especially women and the marginalized groups.

## Just how much gender capacity exists in Africa RISING?

Gender significantly influences their day-to-day work—this is what 60% of Africa RISING's project partners in West, East and Southern Africa indicated in a recent gender capacity assessment. Similarly, in a focus group discussion, members of the project coordination teams said they are strongly commitment to gender equality and a need to do more.

These results are good news for the project as it works towards improving the livelihoods of female smallholders and their children. But this goal will be achieved only if partners have well-developed gender capacities.

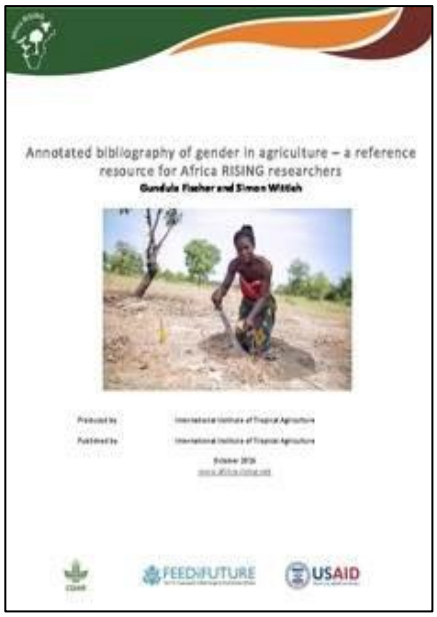
In 2015, the IITA-led Africa RISING projects conducted a gender capacity assessment to focus on the importance of gender capacities for the project's success. The report provides an outline for a capacity development plan that the project team will use to prioritize areas for increased efforts and set a baseline against which continuous capacity building in the project is measured.

Read the full report http://hdl.handle.net/10568/72524

See a related report from the project in Ethiopia

More resources on gender in these projects

## Bridging the know-do gap: Annotated bibliography of gender in agriculture for Africa RISING project partners




More than fifty percent (53.3 %) of scientists implementing research activities in the Africa RISING program indicate not to have sufficient access to gender analytical tools for their research. This is one of the results of the project's recent gender capacity assessment. To bridge this gap, the project's gender team has put together an annotated bibliography of gender learning resources that will ensure project partners can, at a glance, find information and links to selected open access documents addressing particular topics of interest for project partners on gender in agriculture.

"The contents of the recommended resources in this publication range from basic concepts for understanding gender in agriculture to standards for the collection of sex-disaggregated data, tools for gender analysis and participatory field work as well as approaches for increasing women's participation in R4D activities. Specific themes such as gender in mapping, livestock and climate change research are also included," explains Dr. Gundula Fischer, Africa RISING West Africa & East/Southern Africa projects' gender specialist.

The annotated bibliography is an open access publication and can be downloaded at http://hdl.handle.net/10568/77488.

## Publications on Gender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# Nutrition

One of Africa RISING's concerns and objective during phase I include ensuring that the pursuit of sustainable intensification also contributes to complementary goals of enhanced family nutrition and other positive outcomes that benefit, in particular, women and children family members. In line with this, Africa RISING undertook various activities which are covered in the following news stories.

## Boosting production of vegetables among rice farmers to diversify their income and nutrition

In Morogoro, one of the major rice producing areas in Tanzania, the farmers use residue water from rice irrigation to grow vegetables for additional income and to improve their nutrition. They however face many challenges, which the early win research project on "Enhancing vegetable value chains in rice-based and sole crop production systems to improve household income and consumption in Morogoro" aimed at identifying, in order to suggest options to tackle them and to increase the farmers' income and to improve their nutrition by diversifying their diets with safe vegetables.

The project, which was led by the World Vegetable Centre (AVRDC) carried out a baseline survey in Mvomero and Kilombero districts in Morogoro to identify the constraints in the production, marketing and consumption of tomato, pepper, and African eggplant. It also assessed the prevalent pests and diseases attacking the crops on the farms and the contamination of vegetables in the farms and in the markets by microbial, pesticide and heavy metal.

According to the Principal investigator, Victor Afari-Sefa from the World Vegetable Centre in Arusha, the study found that to boost the production of vegetables in the rice-based systems, the farmers need to have better access to quality inputs, such as seeds of improved varieties that are high-yielding and more resistant to pest and diseases, as well as fertilizers and credit facilities. They also need good information on Integrated Crop and Pest Management (ICPM) and better access to extension services.

The research also identified the need to strengthen marketing information systems to lead farmers to bigger and better markets, such as supermarket chains and processors and it found a trade cartel of middle-men who were limiting their returns. The farmers also need training on record keeping and business management skills, Afari-Sefa said.

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The research interviewed 237 farmers and 28 actors along the value chain including seed and agro-dealers, vegetable collectors, wholesalers, retail traders and consumers. The study found that the greatest challenges facing traders were unpredictable markets and fluctuation prices, lack of adequate trading capital, high transportation costs and lack of business and management skills.

The project also trained staff and students of Sokoine university of Agriculture (SUA) in protocols for detecting human and plant pathogens in vegetables.The project partners were the International Institute of Tropical Agriculture (IITA), Africa Rice Center, Sokoine University of Agriculture (SUA), Tanzania's Tropical Pesticides Research Institute (TPRI), Ohio State University (OSU), the District Agriculture and Livestock Development Office (DALDO) for Mvomero and Kilombero districts of Morogoro region, and the Sugarcane Research Institute (SRI) in Kibaha, Tanzania.

Download the project report

More early win' projects

## Mali stories of nutrition and health - where the 'first 1000 days' fit in the first 300 days of Africa RISING

During the early win phase of the Africa RISING project; nutrition-related activities were conducted in Koutiala in the Sikasso region of Mali from July to October, 2012. A total of 36 villages were selected and grouped into 6 clusters mainly by 'commune' with each cluster having 6 villages. The 6 communes were: Medinacoura, Konseguela, Miena, Molobala, MPessoba, and N'Togonasso. These communes were selected based on on-going activities of Médecins Sans Frontières (MSF) on nutrition rehabilitation of severely malnourished children emphasizing the need for malnutrition prevention-related activities.

The partners involved in the nutrition capacity building activities were: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the World Vegetable Center (AVRDC), MSF, and Association Malienne d'Eveil au Développement Durable (AMEDD).

Training modules were developed based on the seven essential nutrition actions (ENA) framework and focusing on the '1000 days' concept. The trainings were divided into four sessions and included topics on: exclusive breastfeeding; nutrition of children 6 months to 2 years old; nutrition and health of pregnant and lactating women; feeding of a sick child and the prevention of vitamin A, iron and iodine deficiencies. Several cross-cutting topics were included such as: dietary diversification (food groups); post-harvest processing of cereals and legumes; preparation of (leafy) vegetables for optimal nutrient retention; hygiene and key messages on the use of ante-natal and post-natal services and the prevention of malaria. The training sessions included demonstration of recipes such as fortified/enriched porridge, sauces with leafy vegetables (with and without groundnut paste), and vegetable soup.

Five representatives – four women and a man- of each village were selected and trained and they in turn trained at least 25 women in their various villages. Cluster-based training of trainers' sessions took place at the 6 health centres and involved nutrition representatives of participating health centres.

This document contains a collection of stories from people who have benefited from the nutrition-related activities such as: representatives of participating health centres, trainers, trainees (mostly mothers) and some of their spouses. The majority of the stories are in Bambara (local language), French and English.

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Download the report

## Promoting dietary and income diversification through vegetable integration into maize/legume systems in Babati, Tanzania

Nearly half of the farmers in the Africa RISING action sites in Tanzania integrate vegetables into their maize-based farming systems as a strategy to increase and diversify their income and diet according to a household socioeconomic characterization survey conducted by Africa RISING.

The baseline survey covered 300 households in 10 villages across maize-based farming system households in the Babati, Kiteto and Kongwa districts where the results showed that, 53 percent male and 43 percent female respondents' integrated vegetables with maize. Its main aim was to determine the potential for integrating vegetables into maize-based farming systems.

The farmers' most important reason for integrating vegetables into farming systems was to increase and or diversify their income followed by nutritional/dietary needs. They also grew vegetables as a relay crop after harvesting maize as a strategy to optimize land resources by growing vegetables on residual soil nutrient and moisture.

The project also organized several sensitization meetings for farmers who grew both vegetables and maize to enhance their awareness on improved as we as traditional vegetable varieties that offer higher nutritional benefits and the potential economic gains.

By the end of the meetings, 71 farmers had been trained. They were also given limited quantities of seed of a set of vegetables: Amaranths (Madira I and Madira II); Tomatoes (Tengeru 2010, Tengeru 97, and Tanya); African eggplant (DB3); Sweet pepper (PP 0042.68), to

grow  on their farms. To scientists' surprise, this triggered farmer –to- farmer diffusion and spillover effect to 140 farmers within the season.

At the end of the cropping season, the collaborating farmers selected vegetable varieties which performed the best in their fields for further cultivation. Farmers' selected varieties were used as a guide for scaling out more demonstrations on good agricultural practices.

The socioeconomic characterization survey was also complemented by a pest and disease survey conducted in 20 farms per district. It combined  a questionnaire to gather farmers' pesticide application regimes and on-site assessment accompanied with laboratory based diagnostics to confirm field identifications.

The results showed that farmers frequently applied pesticides as the incidence of pests and diseases were undoubtedly a major production constraints. The farmers also desired knowledge in pest and disease identification and management so as to minimize the environmental and health risks that could result in uninformed use of such chemicals.

## Turning over a new leaf: How Amaranth farming has transformed the life of a woman farmer in Tanzania

*Ephraim Lukumay in her amaranth field. Photo credit: AVRDC / Inviolate Mosha*

Ephraim Lukumay, a woman farmer in Bermi village, Dareda ward, Babati District of Tanzania, did not think too highly of amaranth a few years ago. *'We did not know the nutritive importance of this vegetable*,' she says. Today she grows amaranth to consume at home and to sell to neighbours and at markets. She is a participant in the Africa RISING East and Southern Africa Project, an initiative to improve agricultural production knowledge and access to modern technologies, such as high performing vegetable varieties in the sub-region.

As part of the project, Lukumay and 70 other farmers learned good production, post-harvest practices and farm record-keeping skills during training sessions hosted by The World Vegetable Center (AVRDC) in September 2013. They were also given improved tomato, amaranth, African eggplant and sweet pepper seeds for planting as a means of ensuring that each farmer grasped the practical aspects of the training.

Currently, about 85% of the trained farmers are growing amaranth alongside tomato, African eggplant and sweet pepper. 'Before we did not have good quality seeds, such as what we have now in our fields,' says Lukumay. 'We are not using any pesticide; the crop is fast-growing and very palatable.

*I grow amaranth in my home garden, and I am confident that I can now contribute some money to supplement the family income and reduce dependence on my husband to provide us with everything*.

'Madira 1', the amaranth variety distributed by AVRDC, grows well in Bermi. '*We can harvest for a long time by cutting the leaves—about six months if we manage it right*,' says Lukumay. She harvested amaranth from her 3 by 15 meters plot for over 10 weeks since the first week of October 2013. 'The first harvest was by thinning; then I left the other plants in a spacing of about 20 by 30 centimetres and then continued to cut the leaves after every vegetative growth.'

Her family of five consumes about 0.5kg of amaranth every day, and she sells more than 10kg every week. 'Many people like the amaranth variety we grow from AVRDC seed,' she says. *'It tastes good and it is very nutritious. Most of my customers are pregnant mothers and families with children under five. When they visit pre-natal clinics, the nurses tell them to eat more amaranth!*'

Lukumay's 13-year-old daughter, Nembris, is the family cashier. Nembris attends Dareda Secondary School in Babati. She assists her mother in the vegetable garden for one hour after school and about 2 hours on Saturdays. Nembris is the family accountant for all the income generated from Amaranth cultivation.

*"We have TZS 20,000 (USD 11) cash in hand now,' Nembris said. 'When we began selling amaranth I didn't keep records but now I do, and we have made TZS 50,000 in the last two and half months*,' she adds.

Lukumay acknowledges the immense value addition of the AVRDC organized trainings to her vegetable production skills. 'This training made us aware of the benefits of amaranth,' she said. 'This crop is now very attractive to us farmers because of the income it generates, and the nutrition it provides.'

## Africa RISING cooking up a legume delight in Malawi


*One of the most popular strategies among farmers taking part in the trainings was the preparation of soya bean-based flour for nutritious soya porridge (mixture of soya, groundnut and maize) as depicted above. This involved wet heating soya bean (in photo A), drying the grain and pounding it together with groundnut and maize, creating highly nutritious soya bean-based flour (photo B).*

Malnutrition and food insecurity remain perennial challenges for families living in rural Malawi. According to estimates by the United Nations Children's Fund (UNICEF), more than two in five children under 5 years (46 percent) are malnourished. Despite this grim scenario, the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) project team is succeeding in combating malnutrition and food insecurity within two rural districts in Malawi–Ntcheu and Dedza–where they have reignited interest among farmers in intensifying production of five grain legumes; groundnut, cowpea, common beans, pigeon pea and soya bean.

Through a 'learning by doing' research approach, the research team has succeeded in changing the perception and attitudes of the farmers towards grain legumes by carrying out a series of nutrition workshops within the two districts.

Following harvest of the 2013/14 crop in May, the team, together with partners from Lilongwe University of Agriculture and Natural Resources (LUANAR) and the Malawi Agricultural Extension Services Department conducted a series of nutrition workshops in each of the four action sites (Kandeu and Nsipe in Ntcheu District, and Linthipe and Golomoti in Dedza District) where research has been carried out over the past three years. During the workshops, farmers were trained on the best cooking techniques for preparing grain legume meals for their families out of

elements like soya bean pods which can be poisonous if not well prepared. The farmers were also trained in the application of simple innovations that involve 'wet' heat cooking which easily destroys the anti-nutritional elements in soya bean pods allowing families to enjoy rich protein diets.

One of the most popular strategies among farmers taking part in the trainings was the preparation of soya bean-based flour for nutritious soya porridge (mixture of soya, groundnut and maize) as depicted above. This involved wet heating soya bean (in photo A), drying the grain and pounding it together with groundnut and maize, creating highly nutritious soya bean-based flour (photo B).

The highly interactive workshops usually begin by dividing farmers into groups composed of both men and women. Next, they are trained on how to prepare simple, tasty and nutritious meals from different grain legumes. The farmers are then given the opportunity to cook the meals. Once the meals are ready, they then open 'shops' in a mock food market where other participants come and taste what each cook has prepared.

So far, the nutrition workshops have attracted the attention of hundreds of farmers and will likely be a significant pull factor for increased local utilization of grain legumes in the two districts considering that nearly all the farmers enjoyed the meals. Through this project and by using the nutrition workshops, the project team has succeeded in improving human nutrition and restoring soil fertility using grain legume farming.

The workshops have also been credited with creating major social changes within the local communities. For example, the local chief (*Nkosi*) of the Ngoni community praised the workshop saying that 'Africa RISING has brought some magic here – cakes from our own crops have substituted beer today!'

## Women 'nutrition leaders' changing the fate of children in Mali

*Women prepare whole grain sorghum Tô during a nutrition field school in N'golobougou village in Mali*

'We must take care of our babies even before they are born. It's like when you want to have good cotton, you need to fertilize the soil to nourish the seeds for a good yield,' says Assa Kayentoo using words that she knows her audience will relate to.

Kayentoo, a 46-year-old nutrition field school trainer, who works for the Malian NGO Amassa in Koutiala in Southern Mali, was among women who recently graduated from the Koulikoro Institute in Mali. She is also a rare example of a divorced financially independent woman bringing up two children on her own.

'Less than a third of adult women in Mali are literate and I need to visually explain the facts about nutrition to the women I target in my work, says Kayentoo. 'I tell them that proteins are like the bricks needed to build a house – without proteins a child won't grow,' she says.

'We must take care of our babies even before they are born. It's like when you want to have good cotton, you need to fertilize the soil to nourish the seeds for a good yield,'

Oral and visual nutrition education is followed by a communal cookery class. 'This week's menu is protein-rich peanut and amaranth sauce, iron and vitamin C-rich *soumbala* (made from *nere* seeds) and wholegrain sorghum porridge,' she adds.

In the N'golobougou community health centre in the south of the country, a brightly painted wall shows a mother feeding her baby with porridge while the older sister in the background holds a school book. Fighting child malnutrition in the Sahel has always been a daunting task. In Southern Mali, over 28% of children under-five are stunted despite this being the grain basket of the country. Malnutrition is especially widespread among children in rural areas. Iron deficiency is a major cause of anaemia, which is particularly severe in this region.

**Scaling up nutrition field schools**

But things are changing. A leader at the community centre says that in January 2015 only 1% of the 6,145 children aged 0-5 years from N'golobougou and neighbouring villages suffered from severe and moderate acute malnutrition.

The centre says nutrition field schools which have been educating women on nutrition and changing cooking habits over the last couple of years are responsible for the improvement in children's health.

Amassa and AMEDD are two of the local NGOs supporting these schools in Koutiala region, where teaching includes participatory cookery sessions with support from the Africa RISING project.

Nutrition field schools target young mothers and pregnant women many of whom are illiterate. This practical culinary approach was designed by Helen Keller International, Institut d'Economie Rurale (IER), the World Vegetable Center (AVRDC) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

The real stars of the show however, are women like Kayentoo and the village nutrition leaders she trains who are chosen from the community for their leadership and child care skills and who later train others in village clusters.

**Social stigma**

A recently trained nutrition leader and mother of four, Aminata Sanogo, has sparked a cookery revolution in the family kitchen. She cooks Tô with whole grain sorghum which was previously unthinkable in a society where women are expected to incessantly pound perfectly decorticated sorghum grains (without the outer seed coat or bran) because women whose Tô has bran were seen as lazy.

Sanogo has been teaching women to cook sorghum and millet grains differently, such as using whole grain or mixing with it with protein-rich legumes like cowpea. So far 290 people have participated in nutrition field schools (94% women) and about 600 households have benefited from collective demonstrations. The consumption of whole grain sorghum increased from seven (baseline household consumption survey) to 96 in the six targeted villages.

Aminata and her husband are changing perceptions and helping break social stigma by showing that whole grain Tô is delicious and healthy. The nutrition value of whole-grain Tô is double that of Tô made when the bran is removed. Eating whole grain not only means better nutrition but also frees up time for women to do other things such as childcare.

Sorghum and millet, which are climate resilient cereals, are crucial staple foods in the rural Malian diet, providing three quarters of the total energy intake of mothers. Yet, while cereals provide about half of the iron intake and up to 75% of zinc intake, the total intake of these essential minerals for child health and development is far below international recommendations.

**Could wholegrain be the way forward?**

But simply keeping the bran isn't the answer. Bran is rich in phytates, which are essential for germination and the main form of phosphorus in grain, but also inhibit the absorption of iron and zinc in the body (bioavailability). However, this bioavailability can be countered through food preparation methods like soaking the grain overnight before milling and by fortifying the food using locally available vitamin C-rich ingredients such as tamarind or baobab fruit, which significantly increase iron and zinc uptake. Data shows that these measures could help increase iron uptake in children by over 50%.

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Sanogo's also gives advice in other health matters. Women participating in these schools are more likely to practice exclusive breastfeeding, which increased from 20 to 89% and pregnant women increase their attendance at the health centre. Some women have also convinced their husbands to give them individual plots where they are now producing cowpea, groundnut and new sorghum varieties.

For Sanogo, this is just the start. Women from villages 10 kms away have asked for the same cookery sessions in their villages and despite not being paid, she says she will go and share her skills because it gives her *maaya-juru,* refertting to the boost in her social networks a highly-valued skills in Bambara culture. Training more women like Sanogo could be a turning point in mother and child nutrition in rural Mali.

## RISING voices: Mariama Fofanah, nutrition specialist at the International Potato Center (CIP)

*Mariama Fofanah, nutrition specialist at the International Potato Center (CIP), introduces herself and her work with the program. It is one of a series of portraits of key people in Africa RISING.*

**Tell us about your background**

I am from Sierra Leone. I obtained my Bachelors (BSc) degree and a Master's of Public Health degree (MPH) in Global Health Nutrition from Johns Hopkins University and George Mason University United States, respectively. My research interests include nutrition, agriculture and health linkages, policy advocacy, social and behaviour change communication. I joined the International Potato Center as a nutrition consultant in 2011 working mostly on nutrition sensitive agriculture program design, implementation and capacity building in particular, promoting food-based approaches to improve nutrition and food security in Ethiopia. Prior to CIP, I worked with health care agencies and NGOs primarily in designing and implementing social behaviour change, advocacy and nutrition promotion programs targeting disadvantaged populations.

**What do you do in your current position?**

Currently, I coordinate nutrition related research activities within the Africa RISING project in the Ethiopian Highlands. My main role is to mainstream nutrition in the design, planning and implementation of research protocols. In particular, I work closely with the Africa RISING nutrition research team as the principal investigator for the protocol "Integrating nutrition in to the crop/livestock farming systems of the Ethiopian highlands for improved nutrition outcomes". Our research examines community dietary practices and behaviours, farming practices, as well as nutrition-related policy and institutional issues. In addition to this, I provide relevant technical advice to implementing partners; help design nutrition education and behaviour change resources and support nutrition training and capacity building. The goal is to gain a thorough understanding of agriculture pathways to nutrition particularly for women and children and to ensure that farmers across all sites are diversifying production systems and diets for better nutrition.

**What are your next plans for Africa RISING?**

"Developing a proof of concept" related to effective agriculture pathways to improved nutrition. Formative research studies and needs analysis are now complete and some of the data has already been analysed and initial results documented in briefs. Our next steps are to share findings, design nutrition education/behaviour change materials, and conduct nutrition training of trainers targeting relevant stakeholders including the bureaus of agriculture, health, innovation platform members and farmer groups. Key outcomes would be empowering communities and strengthening the collaboration between agriculture and health sector to tackle food and nutrition issues. Further work will entail collaborating with other CGIAR partners, government, NGOs and the private sector to look at bio-fortification of staples using

zinc fertilizers, irrigated vegetable production, complementary food processing and nutrition sensitive value chains (milk, butter processing).

**What are the biggest Africa RISING challenges and how do we deal with them?**
Africa RISING project involves complex collaborations among different CGIAR partners, government agencies at local and regional levels and farmers held together by a shared vision. These partnerships are valuable but the challenge is managing and harmonizing wide ranging priorities and perspectives, as well as tracking different outputs, deliverables and finances. Dealing with these issues is a learning process, we focus on achieving the common agenda through effective communication; understanding and valuing what each sector or partner contributes to achieving the common vision.

**What are some of the main achievements of this program?**
In the Africa RISING project sites, farmers face multiple problems of food insecurity, under nutrition, land degradation, lack of alternative income, feed, low crop yields, among others. The project has so far, managed to empower decision makers and farmers to tackle these problems holistically using a systems approach. It has also done well in strengthening local capacities, and ensuring cross-cutting themes of gender, nutrition and climate change are embedded in program planning and implementation.

**What gives you hope looking at a possible second phase, based on the first phase?**
I see the first phase of the project as laying the foundation - finding out what works and learning useful lessons. We now have a strong foundation to build on successes. Based on the first phase, Africa RISING would have a chance to fully leverage the many opportunities identified during the first phase and we should begin to see tangible results, the possibility of out scaling these technologies gives me hope.

## A healthy veggie revolution growing in Tanzania

When Omary Poputo tasted the African nightshade for the first time, he said: “I have neither seen nor tasted this vegetable before, but for sure it is definitely one of the best leafy vegetables I have ever tried.”

Omary hails from Sunya village located in Kiteto District, central Tanzania and is one among the 152 lead farmers spearheading a nutritious veggie revolution in this rural community in central Tanzania with the help of staff working on the Africa RISING – NAFAKA and TUBORESHE CHAKULA scaling project funded by USAID. Through the project, farmers in nine villages located in Manyara and Dodoma regions of Tanzania have been introduced to Amaranth and African nightshade farming.

From the 152 initial vegetable farmers who were trained by the project as “lead farmers”; the project has had a multiplier effect and in the process attracted nearly five times the number of initial farmers in both regions to start growing Amaranth and African nightshade. Currently over 650 farmers are engaged in growing these two nutritious vegetables.

Why Amaranth and African nightshade? The two vegetables are much richer in Vitamin A and micronutrients like iron than the most wide-spread leafy vegetables in Tanzanian villages like the Chinese cabbage and Ethiopian mustard. Deficiencies of in particular Vitamin A can cause night blindness for adults and may reduce bone growth for children. Increasing the intake of Vitamin A is therefore an important objective in Africa in general and Tanzania in particular. According to UNICEF one third of children under the age of 5 are vitamin A deficient in Tanzania and conversely 130 children die every day in the country because they are malnourished.

Deficiencies of in particular Vitamin A can cause night blindness for adults and may reduce bone growth for children. Increasing the intake of Vitamin A is therefore an important objective in Africa in general and Tanzania in particular.

For Omary, it is the sweet taste of the nightshade variety called *'Nduruma'* that convinced him this was a good vegetable variety that could be enjoyed by all in the family; especially children under five years who require high Vitamin A intake. Farmers on the other hand appreciate the drought tolerance abilities of *'Nduruma'*.Omary notes that: "this high drought tolerance capability coupled with the lovely taste enables 'Nduruma' to become a variety that might just soon replace other more popular but less nutritious vegetable varieties"

## Case study highlights Africa RISING's role in improving vegetable production in Tanzania


The Biodiversity for Food and Nutrition global portal recently published a case study highlighting the success of Africa RISING interventions in improving vegetable varieties and production among smallholder farmers in Kilombero District, Tanzania.

The case study explains the innovative approaches used to overcome challenges in vegetable farming, the impacts already being realized and lessons learned by the World Vegetable Center, HORTI Tengeru and other partners who are implementing the project in the country.

The Bioversity for Food and Nutrition global portal publishes case studies (preliminary assessments) of projects that are being successfully implemented around the world linking agricultural biodiversity to nutrition and market outcomes. Download the case study

## Agricultural pathways to improved nutrition in the Ethiopian highlands: dietary practices


Poor diets, inappropriate feeding practices and disease are primary causes of maternal and child under-nutrition. Dietary diversity is an important element of dietary quality, a strong predictor of micronutrient adequacy and overall nutrition status. Intake of a higher number of food items and groups is linked to improved nutritional adequacy of the diet. Ethiopia is making progress in addressing under-nutrition with impressive reduction in stunting rates, however, household and child dietary diversity rates remain low.

This brief by Mariam Fafonah and Zelalem Lema is based on a study by Africa RISING in Sinana and Basona Worena districts which surveyed 240 mothers with children under five to understand the diet diversity and nutritional status of smallholder farmers.

Read the full brief http://hdl.handle.net/10568/77374

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# Climate Change

The most potent manifestation of climate variability that has an immediate impact on agricultural productivity is the change in rainfall patterns – inadequate or uneven distribution of rainfall exacerbated by climate change and already being experienced across all the Africa RISING project countries. The Intergovernmental Panel on Climate Change (IPCC) estimates that climate change in sub Saharan Africa will reduce crop yields by 8% by 2050 (Porter et al., 20148). Climate change is already leading to low and erratic rainfall and sporadic occurrences of droughts in the region which have consequences for crop and livestock production. During its first phase, Africa RISING contributed to building the resilience of small holder farmers in the project countries by helping them: develop and deploy climate-smart technologies, assess the potential risks vulnerabilities as well as impacts of climate change and supporting them to sustainably intensify their production.

## Conservation agriculture for Zambia: A resilient technology in times of climate change

*Mr. Richard Soko in his farm. He planted maize-cowpea rotation as part of his ongoing engagement in conservation agriculture. Photo credit: CIMMYT.*

Climate variability and change is one of the most serious threats to mankind and already affects smallholder farmers in Zambia. Irregular rainfall patterns causing variations in the onset and cessation of rainfall always have a direct impact on famers' lives with unforeseen consequences

on food security and income. Technologies that reduce drudgery, conserve moisture and improve soils fertility over time reduce these risks especially in bad seasons.

Mr. Richard Soko is a farmer who resides in Mugubudu village in Chief Chanje chiefdom under Chanje Agriculture Camp in Chipata District of Eastern Province. He is one of the farmers who has been hosting a conservation agriculture (CA) validation trial implemented by Total LandCare and the Ministry of Agriculture and Livestock under the SIMLEZA-AR project since the inception of the project in 2011. Mr. Soko had been practicing conventional agriculture for 16 years on his 2.5 ha of land before the project started. He grew maize continuously and some tobacco. He traditionally tilled manually creating ridges with the hoe or using a plough, planted locally available hybrids and applied four bags of fertilizer per ha and on average harvested four tons of maize.

Since 2011 Richard Soko's life has changed: he now uses direct seeding (ripper), practices crop rotation with cowpeas, plants improved maize seed and applies the recommended fertilizer rate of 8 bags per ha. When farmers in southern Africa in 2014/2015 experienced the worst cropping season of the last decade, enduring a late start and early ending of rains with dry-spells in between.

Mr. Soko was able to harvest 6.75 tons of maize from his land. He kept 1 ton for home consumption and sold the rest, making US$1,014. He bought a treadle pump for US$180 and has set aside US$300 for inputs in the next season and put the rest in his saving account.

Such is the impact appropriate technology can have on smallholder farmers. "I want to sincerely thank the SIMLEZA-Africa RISING project for bringing new technologies such as conservation agriculture. It has taught me about ripping, planting with a dibble stick, crop rotation and intercropping with legumes, and herbicides application. I learned a lot from my fellow farmers, researchers & extension officers during evaluations and field tours" Mr. Soko said. He also participates in a Total Land Care radio program aired by a local radio station -Radio Breeze to explain what conservation agriculture technologies are, how they work and how he has benefited over the years.

## Africa RISING, the climate-smart way to restore soils in Ethiopia

*Community leader in Debre Berhan, central Ethiopia. His community is behind a water harvesting project, part of the Africa RISING initiative, to protect and rebuild the area's soil. Photo credit: Georgina Smith / CIAT.*

Soil loss in Ethiopia is an expensive problem, adding up to more than US$100 million every year. The country is locked in a cycle of land degradation and poverty, costing it not just money, but soil and crop harvests as well.

> "It may not mean much for a farmer that soil erosion in Ethiopia's highlands reaches over 130 tons per hectare every year," said Lulseged Tamene, CIAT soil scientist in Ethiopia. "Farmers understand better if they can see interventions in the landscape – what erosion means in terms of yield loss, what the major drivers are and how to solve them."

To achieve this, researchers at CIAT and key partners, including CGIAR research centers ILRI, ICRAF and IWMI, and Mekelle University – involved in the Africa RISING project, which stands for the Africa Research in Sustainable Intensification for the Next Generation – have installed erosion plots and hydrological stations to monitor sedimentation and water yield at different scales and with different management practices.

## *RISING above the challenges*

While farmers realized they were losing soil, they didn't know how much, nor how to tackle it. At the same time, researchers had identified top drivers of soil loss, such as poor land management – for example, planting crops on steep slopes – combined with intense rainfall on bare sloped land.

CIAT is leading the Integrated Landscape Management component of the Africa RISING project, which involves collecting and analyzing soil data to advise communities about better land and water management practices, to protect the whole landscape.

Sustainable intensification, the team argued, can best be done through Integrated Natural Resources Management: tackling soil erosion at the whole landscape level – rather than at farm plot level – to transform dust bowls into healthier landscapes able to withstand climate shocks.

Intensification cannot be sustainable at plot or farm level, if the landscapes and watersheds continue to degrade. Research teams worked together with the local community to pin-point land degradation hotspots, and to identify options for how best to manage them.

To show farmers that land degradation is reversible if managed well, an exchange visit was arranged to Tigray Region, where watersheds have been transformed from almost "desert-like" conditions.

## *Africa RISING the climate-smart way*

The Chairman of Adisghe County, near Debre Birhan city, recorded the visit on his mobile phone and showed the footage to his community, inspiring them to transform their eroded landscape.

"I knew that if we did one tenth of the work they did, we could bring our land back," he said.

Through high-resolution satellite imagery, the community has helped researchers identify soil erosion hotspots. Together, researchers and farmers have mapped gulley erosion by looking at satellite images and walking and tracking coordinates, then digitally plotted on maps, and discussed to decide what actions to take.

Two years later, the proof is literally in the landscape. After hands-on training in the field, the community has built check dams, ditches and ponds, and water has percolated through to the lower part of the landscape. Trial data shows doubled yields in some areas following good agronomic practices and appropriate fertilizer application.

This not only improves the structure of the soil – it also improves the retention capacity of the landscape. Especially valuable during drought, more water is now available for farming and other income-earning activities.

Research is still ongoing to collect, analyze and map soil data to build a more complete picture. Challenges remain, among them the need for more communities to start using the approaches that have already worked.

Africa RISING's coordinator Kindu Mekonnen, said: "We have introduced these new technologies, created good partnerships with communities and demonstrated how different technologies are useful. Now we need to take this to the wider scale – we're in the process of working with partners to do that."

Watch a related video

## Local knowledge the starting point for climate-resilient agriculture in Ethiopia - early win project brief

Local knowledge is proving a valuable starting point in adapting Ethiopian farming systems to climate change and ensuring greater productivity to combat food insecurity.

A new brief by the World Agroforestry Centre analyses what farmers in the highlands of Ethiopia currently know about ecosystem processes and the interactions between trees, crops and livestock. The aim is to use this information to guide interventions that will build more intensive and climate-resilient systems.

The brief is the result of the Africa RISING 'Early Win' project on 'Sustainable tree–crop–livestock intensification as a pillar for the Ethiopian climate resilient green economy initiative' led by the World Agroforestry Centre.

Among the recommendations is to ensure that the valuable knowledge held within farming

communities is taken into account when designing local interventions for sustainable intensification.

## Ethiopian farmers made a desert bloom again

*Community member shows how returning leafy matter to the soil improves soil health. Photo credit: Georgina Smith / CIAT*

Ethiopia is in the middle of the worst drought in 50 years. It's the sort of shock to the system we are likely to see more of with climate change. But Ethiopia is also home to a successful experiment to make the land more resilient to drought. If we are going to adapt to our changing world, it's experiments like these that will show us the way.

In the steep fields of Ethiopia's highlands, when rain falls on the parched, overworked land it runs downhill, carrying soil with it. Farmers commonly lose 130 tons of soil per hectare a year, comparable to the worst erosion documented on U.S. farms in recent history. Then, because the water has all rushed downhill, instead of seeping underground, wells go dry. Without water, crops wither, and that exposes bare soil to further erosion.

This cycle turned a watershed in Tigray, Ethiopia, into a near desert, prompting the government to consider moving the farmers. Instead, they decided to try to rescue the land. And they succeeded. Instead of leaving their homes, the farmers are staying put. As one local official put it, what was once a desert is now a forest.

Inspired by this success, farmers are trying the same thing in Adisghe County, Ethiopia. With the help of an international project called Africa Research in Sustainable Intensification for the Next

Generation (Africa RISING) and the Ethiopian Bureau of Agriculture, they began building dams, terraces, and recharge ponds. They planted trees on hilltops and planted cover crops on degraded areas.

All of these methods had the same goal: Slow down the water. So, for instance, the farmers built check dams across gullies to stop the headlong flow, catch the eroding earth, and create a pool that would percolate into the ground.

Thanks to increased water reliability, agricultural training, and precise use of fertilizer (synthetic and manure) farmers have doubled their production since the project started.

This wasn't easy. Lulseged Desta, a soil scientist and landscape ecologist at the International Center for Tropical Agriculture working with Africa RISING, told me that farmers must set aside up to two months a year for building dams and planting trees. What's the value of all that work? When organizers calculated how much it would have cost if they had hired laborers to do all that work, it added up to $2,200 for one project of about four square miles. That's a lot of money in Ethiopia, but it's certainly less than the cost of resettling families.

This project was never meant as a silver bullet to solve the drought. The lowlands are still suffering. But it is part of the larger solution: This sort of transformation, writ large, can cushion climate crises. It helps to have these farmers at home producing food rather than facing migration. And, Desta said, these kinds of soil restoration efforts are now spreading around the country.

Climate change hits poorest places the hardest. One reason is that they simply can't afford a lot of common-sense environmental protections. This Ethiopian test case shows us that, with a little investment and a lot of hard work, the most vulnerable places can become dramatically more resilient.

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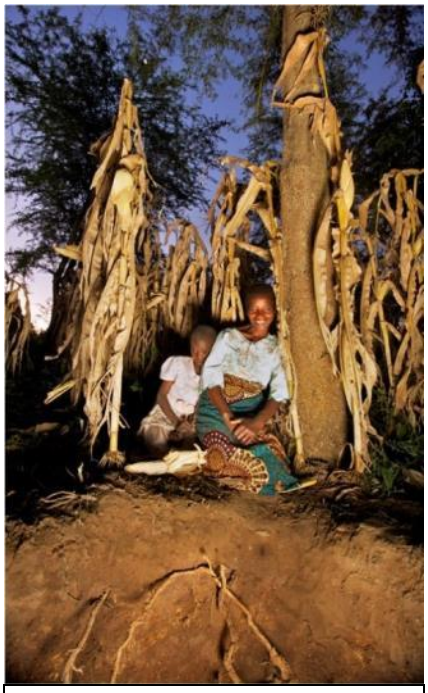
# Soil and Water Management

The level of natural resource vulnerability varies widely across the Africa RISING intervention areas. In the 5 project countries, the project has been implementing different interventions aimed at addressing localized NRM challenges to ensure small holder farmer communities nurture sustainable natural resource capital (soil and water) – both at household and landscape level. The following stories highlight some of the work and success achieved by the project

## Integrating perennials with food crops could restore soil health and increase staple yields

Rhoda Mang'yana's half-hectare farm in Malawi produces more maize (corn) than her extended family of seven can eat. Some of the extra crop she sells. Some she feeds to pigs and goats, which she also sells. With the money she makes, she can pay her grandchildren's school fees and buy essentials, such as soap and salt, that she has provided for her family since her husband died 15 years ago. As well as maize, Mang'yana's farm supplies firewood and other types of animal feed. It is also resilient, providing enough maize during good years to pull the family through leaner ones. Key to Mang'yana's improved land is perenniation — the integration of trees and perennials (plants that live for two or more years) into fields of food crops.



*Rhoda Mang'yana grows maize near her 'fertilizer trees' to improve her farm's crop yield and soil fertility. Photo credit: Jim Richardson*

When Mang'yana acquired the farm in the 1990s, soil degradation limited its annual maize yield to less than 1 tonne per hectare — a common yield in Africa, but one-tenth of those seen in the Corn Belt of the US Midwest. To improve the soil, she began growing perennial pigeon peas (*Cajanus cajan*) and groundnuts (*Arachis hypogaea*), which require less fertilizer and add nitrogen to the soil[1]. She also began using 'evergreen agriculture', planting various nitrogen-fixing trees[2] that each meet different needs. Fast-growing, short-lived plants such as *Gliricidia sepium* provided firewood and animal feed; slower-growing, longer-lived trees such as *Faidherbia albida* improved long-term soil fertility.

After a few years, Mang'yana resumed growing maize. Better yields allowed her to invest in pigs and goats, and she began using the animals' manure along with mineral fertilizer on the fields. Now she produces four tonnes of maize per hectare in a good year. Most of Africa's soils are naturally poor in nutrients compared with those of the younger landscapes found in North America, for example. Only about 16% of Africa's lands have the high-quality soils best suited to supporting livestock and crops; roughly 29% are marginal; and the rest are unsuitable for farming[3]. Farmers often worsen already poor lands by removing more nutrients than they return to the soil[4].

Population growth and erratic weather driven by climate change are exacerbating the problem[5]. Although cereal production grew by 2% a year in most African countries during 1961–2003, the population grew faster (2.6% annually), leading to an overall 43.5% decline in per capita cereal production over that period[6].

About one-quarter of the world's undernourished population — some 240 million people — live in sub-Saharan Africa. Of the various factors needing urgent attention to increase agricultural productivity, scientists from the region have identified soil quality as a top priority[5]. We believe that perenniation should be used much more widely to help farmers to meet the challenge of improving soils while increasing food production.

## *Deep roots*

Many African farmers struggle to meet the nutrient needs of their crops. Because organic sources such as animal and plant manure are often in short supply in Africa, governments and development agencies tend to promote mineral fertilizers as the solution to low soil fertility. But investing in fertilizer can be risky — during a drought year, for instance, farmers might not produce enough to cover the costs. And without organic inputs, mineral fertilizers do little to improve soil conditions, and can even worsen them by hastening the loss of soil carbon[7].

Perennials can gain access to more of the soil's nutrients and water, for a longer time than annual crops. Their roots often extend more than two metres deep (compared with less than a metre for most annuals), and their growing seasons are longer. These attributes make them more resilient to harsh environmental conditions. Because they produce more biomass, both above and below ground, they are better at reducing soil erosion, transferring organic inputs to soil microorganisms and increasing the amount of carbon stored in the soil — a key component of soil health[8]. These organic inputs and microorganisms then improve soil fertility and structure as well as increase water infiltration and storage — all of which increase the amount of water available to and used by crops[7, 8]. Moreover, by supplying the soil with carbon, perennials can improve the ability of food crops to use mineral fertilizers and, potentially, help farmers to adapt to climate change[1, 2, 8].

Here we highlight three perenniation approaches that show particular promise in sub-Saharan Africa: evergreen agriculture and doubled-up legume systems, such as those used by Mang'yana, and a technique for managing crop pests called 'push–pull'.

Evergreen agriculture is the best known and most widely adopted of the three. Hundreds of thousands of farmers across the Sudano-Sahelian zone and into East and Southern Africa grow 'fertilizer trees' along with maize, sorghum or millet on more than 5 million hectares of cropland[2]. The leguminous trees in these systems, such as *Faidherbia albida*, can triple maize yields while improving the soil. The trees meet other needs as well — they provide firewood and livestock fodder, for example[2].

In doubled-up legume systems, which have now been adopted by more than 8,000 households in Malawi[1], farmers grow perennial pigeon pea along with annual legumes such as soya beans (*Glycine max*) or groundnuts. After harvesting the legumes, farmers plant maize in or beside the rows of pigeon peas and then harvest both. Farmers can use different types of pigeon pea, depending on how much grain they need for food and leaves and stems for animal feed or

manure. They can also change the timing and arrangement of planting to favour the maize or the legume. Nutrient- and protein-rich, pigeon peas can persist into the drier months, after maize stocks have been exhausted[9], and they can substantially improve families' diets.

Perennial plants can help to manage pests and diseases. More than 30,000 farmers in East Africa have adopted push–pull systems to manage stem-borer moths (*Chilo partellus*) and African witchweed (*Striga hermonthica*), both widespread in sub-Saharan Africa. In this method, silverleaf (*Desmodium uncinatum*), a perennial leguminous animal-feed crop, is interspersed among maize plants. The silverleaf produces chemicals that repel or 'push' pests away, and perennial Napier grass (*Pennisetum purpureum*) grown around the edges of the fields 'pulls' the pests in by providing attractive leaves for egg-laying. Push–pull systems can more than double maize yields by reducing pests[10] and increasing the amount of nitrogen in the soil.

Each of these three soil-building systems can be adapted to specific types of farming, such as conservation agriculture, organic or conventional management or production of both crops and livestock.

Organizations such as the US Agency for International Development (USAID) and the World Bank have made sustained investments in strategies discovered and developed by farmers, and these efforts have proved crucial in battling hunger over the past 50 years. Irrigation and fertilization have become specialized scientific disciplines, sparking the creation of dedicated research institutes around the world.

In many regions of Africa, farmers have taken some perenniation approaches well beyond the proof-of-concept stage. Yet many questions remain — such as which species are best suited to which types of land, and how to maximize productivity in different areas. We believe that perenniation, along with technologies such as improved seed, fertilization and irrigation, should be a priority for the international agricultural research-and-development community. This means scaling up the use of approaches known to work, such as evergreen agriculture (in suitable areas), and backing research in cultivars and techniques that farmers have not yet tested widely.

## *Scaling up*

Some efforts to expand perenniation are already under way. Last month, a four-year project called Trees for Food Security was launched by the World Agroforestry Centre, an international research institute based in Nairobi, Kenya, that has led the development of evergreen agriculture. The centre aims to plant millions of trees on farmland throughout sub-Saharan Africa, in partnership with the governments of Ethiopia, Rwanda, Burundi and Uganda.

Similarly, the International Crops Research Institute for the Semi-Arid Tropics, based in Patancheru, India, has worked for more than two decades with pigeon peas, collecting and characterizing cultivars and educating farmers about their use. The institute's collaboration with Michigan State University and others has boosted the use of doubled-up legume systems considerably over the past 10 years, particularly in Malawi[1].

Many research institutes, including Washington State University in Pullman[8], have taken up the development of perennial grains more broadly. And USAID is investing US$9 million annually in

Africa Research in Sustainable Intensification for the Next Generation, a programme that includes support for the study of perenniation strategies (www.africa-rising.net). Yet these are drops in the ocean compared to the scale of need.

Giving perenniation the kind of support now directed towards technologies such as mineral fertilizers and seed development could require hundreds of millions of dollars. According to Chris Reij, an expert in African agriculture at the World Resources Institute in Washington DC, $50 million would be needed even to “show how existing successes [in agroforestry] could be scaled up”.

Yet such numbers pale in comparison to the losses of nitrogen, phosphorous and potassium from sub-Saharan farm fields each year, which are estimated to be equivalent to billions of dollars in fertilizer[4].

Sub-Saharan Africa's population is expected to reach 1.5–2 billion by 2050. Already the population is ballooning; in many areas, the risk of drought and flood is increasing; most soils are poor; and richer nations are buying up Africa's arable land for their own food or fuel security. African farmers have demonstrated the promise of perenniation. It is time to scale up its use and put it firmly on the research-and-development map.

## Using films to support large-scale training on Striga and soil fertility management in Mali

*Members of a farming comunity in Sindalla Village, Mali during an evening video show on striga weed control by Africa RISING*

For the past 40 years, scientists from international research organizations such as the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT), the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA) have invested heavily in finding solutions to one of the world's most troublesome weeds, known as witchweed or *Striga*. Of great concern to African farmers, this parasitic weed damages maize, sorghum, millet, rice and fonio. While developing *Striga*-resistant crop varieties is a key area of research in *Striga* control, researchers have also developed insights into how soil fertility management and other options can help to reduce *Striga*.

Over the years, scientific knowledge alone has proved insufficient in managing *Striga*, as researchers and agricultural extension agents have struggled to communicate effectively with farmers on the complex processes of managing the weed. Since 2006, ICRISAT and partners have conducted farmer field schools to experiment with a wide range of *Striga* control options. As a result, practical and profitable integrated *Striga* and soil fertility management (ISSFM) practices were developed for pearl millet and sorghum. However, bottlenecks such as the scarcity of skilled trainers and maintaining quality training have hampered efforts in scaling up the new practices.

But new efforts and intense collaboration between a private company Agro-Insight and ICRISAT partners in Niger, Nigeria, Ghana and Mali have led to the production of a series of 10 farmer-

to-farmer videos on ISSFM practices. The films, produced in French and English and translated into six other major West African languages (Bambara, Bomu, Hausa, Mooré, Peulh and Zarma), were first produce in 2012.

## *Partnerships for distribution, viewing and use of 'Fighting Striga'*

The series of films, which are packaged in DVDs, is called 'Fighting Striga' and a comprehensive distribution and monitoring plan for the films was made with key stakeholders from Mali, Niger, Nigeria and Burkina Faso. Partners included local, national and regional organizations, ranging from national research institutes, chambers of agriculture and NGOs to farmers' organizations, rural radio stations and seed companies. Of 30,000 DVDs produced in Mali and Nigeria, over 20,000 copies have already been distributed to a range of organizations and individuals, representing old and new partners. ICRISAT distributed individual or large quantities of DVDs to partners and other strategic development agencies (first level), These first level partners further distributed the DVDs within their networks (second level), which in turn distributed copies even further (third level). Intensive data collection and monitoring reveals that within a year the DVDs had reached over 2,000 representatives of about 700 organizations from 43 countries.

*Fighting striga using evening video shows - a farmer trainer introduces himself to residents of Sindala village, Mali*

Partnerships were key to large-scale viewing and dissemination of the videos as the numbers of viewers rose to over 15,000 within 9 months, mostly as a result of partners' efforts. Although it has been a challenge to collect feedback from (especially non-contracted) partners, many enthusiastic new partners have provided interesting feedback. Several NGOs, farmers' organizations and rural radio broadcasters have responded positively to the request for feedback and often requested more DVDs, technical support documents and training of their field agents. According to them, the videos represent an opportunity to quickly acquire new knowledge on the subject and to engage with large numbers of farmers for exposure to, and discussions about, ISSFM. They also noticed a shift in the roles of field agents, technicians and researchers, who evolved from being teachers to facilitators in knowledge exchange between farmers and other stakeholders.

'They [the farmers] enjoyed watching the [Arabic versions of the] videos, which encouraged them to comment and fully participate in the discussions,' said Noureldin Ahmed Abdalla of the Sudan Meteorological Authority in Khartoum, Sudan.

While it is too early to assess the impact of these films, several partners in Mali and Niger observed communities mobilizing themselves to hand pull Striga near the end of the 2012 rainy season, as well as many farmers digging and filling compost pits. According to the partners, the farmers said their actions were a result of watching the videos.

'The communities understood that fighting *Striga* requires concerted efforts to attain results, and I have already seen examples of community action to hand pull *Striga*,' said Ali Mamane Aminou of the farmer organization Fumagaskiya in Maradi, Niger.

While the primary goals of the videos were to train farmers and extension agents, several universities in Africa and Europe have included the DVDs in their BSc and MSc curricula. They found the videos useful in illustrating the reality of smallholder farming in Africa, while at the same time showing new technologies and approaches to participatory research.

The Fighting Striga videos are effective because they are made according to the 'zooming in' and 'zooming out' method. This method relies on strong interactions with farmers who have been involved in participatory approaches such as farmer field schools and results in regionally relevant and locally appropriate farmer-to-farmer training videos.

## *Promotion, buy-in and investment efforts from new partners*

The international NGO Access Agriculture, which has established a video- and audio-sharing web-based platform devoted to supporting agriculture in developing countries, has made it possible to watch and download videos for farmers. Videos are also made physically available by large-scale multiplication and dissemination of DVDs based on national demand. In the meantime, the videos have been translated into seven languages for northern Ghana (Dagaari, Sisaala, Dagbani, Gonja, Kusaal, Buli and Frafra). Several governmental and non-governmental organizations have also discovered the quality and relevance of the videos and decided to invest in translation them into Arabic, Portuguese, Swahili (Kenya), Chichewa (Malawi), Dendi, Bariba and Nago (Bénin). Some agencies also supported large-scale production of DVDs and broadcasting the videos on national television, increasing visibility and availability even further. Through the promotion efforts of ICRISAT, Access Agriculture and partners, the videos are now reaching agricultural service providers and farmers not only in Western, but also in Eastern and Southern Africa. Africa RISING is one of the partners that paid for translation of the videos and also helped in distributing them. In July 2013, the project also created awareness among extension agents at a workshop in Ghana.

## Let's talk about money! Economic benefits of integrated Striga and soil fertility management in West Africa

For the last five years, the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) and its partners have conducted farmer field schools (FFS) that aim to develop practical and affordable methods of integrating *Striga* and soil fertility management (ISSFM) among farmers in Mali, Niger and Nigeria. The process of setting up these schools started with village meetings in which scientists, technicians and both male and female farmers got to know each other and discussed the local agricultural situation, main (rain-fed) crops and cropping systems. Focus groups then tried to quantify or map the occurrence of constraints in the village and possible reasons for these. Further exchanges took place to determine local knowledge about *Striga* and soil fertility and what farmers could do to deal with these problems. These engagements produced a common understanding which formed the basis for further activities. Where farmers were interested, further plans were made to organize a farmer field school around the topic of *Striga* and soil fertility.


*A farmer takes part in a cost-benefit analysis exercise. Photo credit: ICRISAT*

During further preparatory meetings, FFS participants were chosen by the villagers, an experimental field was identified and rules and responsibilities of the partners were determined. With the participants, a cropping calendar and protocol were developed for the dominant farmer practice (FP). Then, after having discussed local options for *Striga* control and increasing soil fertility and having amended these with any relevant options from research, the groups developed an ISSFM practice.

During the season, FP was tested against ISSFM on large plots and farmers observed the crops, *Striga*, their environment and other biotic constraints such as insects, weeds and diseases. They also learned more about crop development, soil fertility and fertilizers and *Striga* biology and control through interventions by specialists (technicians, scientists and sometimes other farmers). ISSFM can include intercropping of cereals and legumes, application of organic and mineral fertilizers, crop management practices such as ridging or hand-pulling S*triga* at flowering stage and sometimes cultivating a variety of cereal crop that is resistant to *Striga*.

After completing the trial, harvesting the plots and threshing and weighing the yields, interesting results were found. It became obvious that this approach can significantly reduce the *Striga* population and improve crop productivity and soil fertility in the long term, but the most important question that farmers posed was: ***Can we make money while applying this ISSFM practice?***

This question is important and has become an essential part of the comparison of FP to ISSFM. At the end of the season, farmers participated in calculating the costs, revenues and profits of the two practices tested during the season. The economic analysis is a simplified version of what economists call a 'partial budget analysis'. It consists of some simple phases that are, however, not always easy for farmers to follow.

The first phase involves comparing the yields of grains by weighing and by counting the number of bundles of stalks or haulms from FP and ISSFM plots. The second phase consists of listing the different activities for FP and ISSFM, and summing up labour requirement (in person-days) for different operations for FP and ISSFM. The additional labour required for ISSFM (compared with FP) will be taken into account later as a cost for the ISSFM practice.

The third phase consists of calculating the costs, revenues and profits for FP and ISSFM. Costs (units of inputs such as seeds, fertilizers etc., multiplied by their market price at sowing) are deducted from the revenues (units of harvests multiplied by their current market price per unit) to calculate the profit for both practices.

This approach will be used in Africa RISING as an integral part of the evaluation of trials on a range of crops and agronomic practices. In this way, the project will make sure farmers' decisions on the use of technologies in their own fields will be based not only on information about yield (agronomy and variety characteristics), but also on information about the costs (as a function of labour, seed, fertilizers, etc.) and benefits (net benefit, rate of return to investment) of technologies and crops tested.

Once the costs, revenues and profits have been calculated, a well-informed comparison can be made between the two practices by the farmers. This always leads to lively discussions!

The final stage involves citing the advantages and disadvantages of individual component technologies used in the ISSFM practice, followed by preference ranking of these technologies.

### *Lessons learned*

- ISSFM requires more investment in terms of money and labour, but almost always leads to higher profits.
- The return on investment of ISSFM is often lower than that of FP, and this is a constraint for farmers to adopt the practice as tested in the FFS.
- After having done the economic analysis, farmers now have the right information and capacity to choose which technologies to adopt in their own fields based on their needs.
- A sufficient quantity and quality of organic fertilizer is hard to find, and one needs animals, equipment and labour to produce, transport and apply it.
- Mineral fertilizer requires a cash investment at a time when no money is available; therefore, credit for buying fertilizer is essential.
- Changing from a pure pearl millet or sorghum crop to an intercrop with legumes can increase profit significantly for farmers because animal feed from cowpea and groundnut haulms fetches high prices.

This approach will be used in Africa RISING as an integral part of the evaluation of trials on a range of crops and agronomic practices. In this way, the project will make sure farmers' decisions on the use of technologies in their own fields will be based not only on information about yield (agronomy and variety characteristics), but also on information about the costs (as a function of labour, seed, fertilizers, etc.) and benefits (net benefit, rate of return to investment) of technologies and crops tested.

## Cataloguing tested crop, soil, and water management options in Tanzania, Malawi, and Zambia

Various organizations have developed and promoted many practices aimed at improving yields, and managing water and soil at the farm level. Which of these have farmers really adopted and what factors have led to the adoption or non- adoption? Which of these are really effective and can be scaled up in the Africa RISING project?

The early win project on 'Cataloguing tested crop, soil and water management practices in Tanzania, Malawi and Zambia,' led by the International Centre for Tropical Agriculture (CIAT), took stock of all technologies introduced to small-holder farmers in Tanzania, Zambia and Malawi to improve production of important staple crops and assessed, through existing literature and documents, their accessibility and adoption and the factors that drove the adoption.

The technologies included cereal legume rotation and intercropping, conservation agriculture, fertilizer recommendations, agroforestry, and combining organic and inorganic fertilizers, among others. Cereal and legume rotation and intercropping, and combining inorganic fertilizers with organic inputs were identified among the promising technologies to increase productivity in the target areas and conservation agriculture showed promise in conserving soil water. The study recommends these technologies for further validation before scaling up to attain sustainable intensification under Africa RISING.

Patrick Mutuo from CIAT, one of the researchers, says the study found that most of the technologies introduced to the farmers were not well adopted due to the

unavailability/affordability of required inputs such as seeds, manures and fertilizers; their benefits were not so obvious to farmers such as in the case of non-food/cash grain legumes; and some of the technologies had delayed benefits.

The study identified the insufficient/inadequate number of agro-dealers, especially in Zambia and Tanzania, as one of the potential barriers to the adoption of the technologies. “In Malawi, we found there was one agro-dealer per 1,550 households, in Tanzania it was one per 2,200 households while in Zambia it was one for 3,080 farming households. With the recommended ratio being between 500-1000 farmers per agro-dealer there is therefore a strong need to support and enhance agro-dealers’ networks if we want to facilitate farmers to adopt new and improved technologies” Mutuo said.

Looking at the policy environment, Mutuo says the policies in the three countries were fairly good and supported sustainable intensification.

The main challenge, however, was their implementation. He further said that there are sufficient dissemination approaches and training materials developed by different organizations and government departments on these technologies. However, they were mostly in libraries and not with the farmers. Extension services were also found to be poor.

The study used the Land Degradation Surveillance Framework (LDSF) approach to characterize and identify degradation *hot spots* within the target areas.

From the few sentinel sites mapped, most of the soils have low carbon content and there was a high risk of soil erosion in cultivated and non-cultivated areas.

Mutuo says areas for further research include evaluating and validating the agronomic, economic, and environmental performance of entry points such as right crop density, right spatial arrangement, time planting, weed management, appropriate varieties. These should be combined with the use of models and decision-support tools for technology identification (for site-specific recommendations) and trade-off analysis.

**Download the project report**

## Participatory research proves effective in changing farmers misconception on fertilizers in Tanzania


*One of the farmers taking part in the participatory trial shows his healthy looking maize as a result of improved farming practices including use of fertilizer. He is looking forward to a good harvest. Photo credit: E. Massam*

The strongly held but wrong perception among farmers in Babati District that use of mineral fertilizers destroys the soil is a major cause of the low crop yield in the district.

The low agricultural productivity in turn leads to periodic food shortages, undernourishment and dismal livelihoods especially among resource poor small scale farmers. Soils in Babati are deficient in key nutrients mainly Nitrogen (N) and Phosphorus (P). Most farmers mine the soil for nutrients because farming practices are characterized by non-use of fertilizers or, at best, use of poor quality manure.

The Babati research team conducted farmer participatory research during 2012/13 and 2013/14 to demonstrate the impact of locally-available Minjingu fertilizers on the yield of improved maize varieties intercropped with an elite pigeon pea variety called Mali (ICEAP 00040).

In the first year, fertilizer treatments comprised of Minjingu Phosphate Rock (0% N, 13%P, 0% K), Minjingu Mazao (10%N, 9%P, 0%K) and DAP (18%N, 20%P, 0%K) applied through micro-

dosing at a rate of 20kg P/ha at planting. All treatments were top dressed with split applications of urea at the rate of 60kgN/ha: 30% at planting and 70% at knee high stage.

Minjingu fertilizers which are relatively new on the market, are cheaper than other fertilizers sch as DAP. In one of the villages (Sabilo), yield gains in response to fertilizer application were 3.8 t/ha for Minjingu phosphate rock, 4.1 t/ha for Minjingu mazao and 4.6 t/ha for DAP compared to 0.71 t/ha under farmers' practice.

Preference for the P fertilizer brands varied between villages but Minjingu mazao was popular in two villages (Seloto, and Long), while Sabilo village opted for Minjingu phosphate rock. Preference was based on the level of yield increase in response to the brand of fertilizer, fertilizer availability, price and nutrient composition of the fertilizer.

Several farmers in Seloto and Sabilo have also taken up good agricultural practices including optimal spacing, correct fertilizer application and improved varieties as a result of their involvement in the project. For instance, Mrs Elizabeth S. Miindi and Mr Paulo Yawaki used DAP and Minjingu Mazao fertilizers with improved maize and pigeon pea seed this year ,2013/14, and they produced 62 -75 bags each weighing 100kg per hectare.

This change of mindset on using improved agronomic practices including fertilizer is a very key step towards increased productivity, income generation and livelihoods improvement for farmers in Babati district.

## Mechanizing fertilizer microdosing technology: Producers and extension agents trained in Mali

In June 2013, 29 farmers, members of farmer organizations (UCPTC) and field agents of NGOs (AMEDD, AMASSA) from Sikasso, Segou and Mopti regions of Mali attended a training session in Koutiala on mechanization of fertilizer microdosing. Applied manually until now, microdosing addresses the problems of low soil fertility, access to fertilizers and difficult climatic conditions in the Sahelian and Sudanean ecological zones. The technology, developed by the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) and partners, has contributed to increased production, productivity and farm incomes.

As a result of previous projects carried out by ICRISAT and partners such as the Alliance for a Green Revolution in Africa (AGRA) Microdose Project, some 25,000 smallholder farmers in Mali, Burkina Faso and Niger obtained 44-120% more yield in sorghum and millet, along with a 30% increase in family incomes. As a result, many farmers and producers agree that fertilizer microdosing is relevant and profitable. However, a major constraint in using the technology, is that it is labour-intesive and time-consuming making it's use unsustainable for many smallholders.

*A technician explains how to use equipment for mechanical placement of seed and fertilizer*

Kamkam Woumou is a research assistant at the Institute d' Economie Rurale (IER) who provided the training. According to Woumou, 'one constraint producers face when fertilizers are applied manually is the amount of time and labour required. IER scientists and partners were inspired to conduct research on mechanization of fertilizer microdosing technology by producers who mixed fertilizer with seeds at sowing to reduce this labour,' he said.

The new equipment developed by IER and its partners (including NORAGRIC and GCOZA) consists of a special disk and a particularly innovative planter based on the principle of simultaneous seed sowing and fertilizer application. Real-time work required (sowing and application of microdoses) for 1 ha can be reduced from 12 person-days when fertilizers are applied manually to a 1 person-day. In addition to reducing time and labour, mechanizing microdosing also helps farmers plant seedlings in straight rows and use the appropriate quantity of seeds and fertilizer for each pocket, optimizing productivity. The efficient use of fertilizers

results in vigorous growth of the plants.

The first day of training, held in the Catholic mission in Koutiala, consisted of a presentation on the mechanical placement of seed and fertilizer. On the second day, participants were introduced to the equipment and its settings using different types of disks during a practical field session. Mechanization is based on the use of a disk placed inside the planter. The soaked seeds mixed with the fertilizer are administered using the planter at 30-50cm distance between pockets. The disks are manufactured by blacksmiths and controlled and tested by IER.

The training was further complemented by a screening of 'Fighting *Striga*' videos, which introduced a range of technologies to manage *Striga* and soil fertility such as intercropping, microdosing and compost production. At the end of the training, participants planned for trials in their intervention villages and protocols were developed for the experiments. Mechanized microdosing will be tested in Koutiala District as part of the Africa RISING project. If tested successfully, the technology will be made available on a large scale in Mali.

This training session was organized by ICRISAT in collaboration with IER as part the United States Agency for International Development (USAID)-funded project Africa RISING and aligned with the CGIAR Research Programs on Dryland Systems and Dryland Cereals.

Youtube https://www.youtube.com/watch?v=c4-AB1jg3Sg&w=420&h=315

## Conservation agriculture is giving us more food and money: A Zambian farmer's story

Damiano Tembo talking about his latest crop of maize under SIMLEZA-Africa RISING, which he expects to be even better than last season's harvest. Photo credit: IITA/Jeffrey Oliver

Conservation agriculture (CA) – also called 'agricultural environmental management' – is defined by the Food and Agriculture Organization of the United Nations (FAO) as 'a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment'. In the light of a booming population, CA has become critical over the years as more food needs to be produced annually to meet ever-growing demands. This scenario is especially pronounced in Africa where stagnant productivity, shrinking resources, expanding population, environmental degradation and a changing climate threaten the livelihoods and food security of millions of agriculture-based households.

Under the SIMLEZA-Africa RISING project, the implementation of CA technologies is a key intervention. For just the past 2 years, the project has already seen positive outcomes on the practices and lives of its farmer-beneficiaries in its target communities in the Eastern Province of Zambia. Below we highlight one of our farmer 'success stories' who have been practicing CA technologies introduced in the country by the project.

### *Damiano Tembo, Kafwumbwe Camp, Katete District*

'I first heard about the [SIMLEZA-Africa RISING] project during the community sensitization meetings conducted by staff from the Ministry of Agriculture. And although I have heard of CA before from my fellow farmers under the Conservation Farming Unit (CFU), I have never tried my hand in it,' began Damiano Tembo, a SIMLEZA farmer-beneficiary.

'After the sensitization activities, the SIMLEZA project staff and agricultural extension officers conducted another training on CA technologies, particularly the use of dibble sticks, in which I also participated,' he added. 'This ignited my interest especially when they explained the benefits that I could derive from practicing CA compared to using traditional farming methods.'

Tembo, who is also an active community volunteer, has five plots which serve to compare the different CA technologies and practices such as the use of dibble sticks and rippers, herbicides, basins, and hybrid seeds. In his first plot, on which he planted maize, he practices what he calls 'old' – or conventional – way of farming. In his second plot, which is also planted to maize, he uses dibble sticks in planting and has set up 'basins' for water retention. In his third plot, he also practices the use of dibble stick and intercropping maize with cowpea. In the fourth and fifth plots, Tembo uses dibble stick while rotating maize and cowpea. In all the CA plots, he applies herbicide to manage weeds.

He further explained that for the fourth and fifth plots, he rotated maize and cowpea interchangeably. 'During the first year of planting under CA, I planted cowpea in my fourth plot and maize in my fifth. The following year (2013-2014 season), I reversed the crops – maize to replace cowpea in my fourth plot and cowpea to replace the maize in the fifth plot. Next year, I will reverse the crops again.'

Asked what he has observed as immediate benefits of CA over traditional farming, Tembo says, his CA plots yield much more than the traditional plot (first plot). 'During my first harvest under SIMLEZA-Africa RISING, I only harvested two 50kg bags of maize from my conventional plot, compared to about four 50kg bags from each of my CA plots,' he says.

He adds that "from the previous season, I got 40 50kg-bags/ha of maize from my conventional plot, while I got about 80 50kg-bags/ha of maize from each of my CA plots. This is double my usual harvest!'.

Because he uses herbicides in the CA plots as espoused by the project, Tembo spends less time and labour weeding, enabling him to pursue other income-generating activities. He sprays herbicide at the start of the planting season to control the growth of weeds and he devotes time saved to other crops that required additional manual labour such as cotton, sunflower and groundnuts. 'Basically, with CA, I now get more income for the same time and labour spent,' he says.

Additionally, Tembo has observed that in the CA plots, grass is growing better indicating much healthier soils. The use of CA retains soil nutrients leading to much better yields from crop-rotated CA plots compared to the conventional monocropped areas.

'In the CA plots where I have 'basins', the soil stays wet longer than in my conventional plot. This, to me, is evidence of better soil moisture retention under CA, which is beneficial to my crops,' he says.

*Tembo with his wife in front of the house which he was able to build from the proceeds of last year's harvest under SIMLEZA-Africa RISING. Photo credit: IITA/Jeffrey Oliver*

So what has he do with the extra income from CA?

'From the extra earnings I got from last season, I bought fertilizer from the cooperative, which I have used for the current season. I also used some of the money to pay for my children's school fees, to buy some livestock such as cattle and goats, to buy food and other household items and to extend my house,' he says. 'My family is very happy!'.

Asked if he has shared his knowledge and experience of CA with other farmers in his community, Tembo replied that during the 2012-2013 season, 'I taught about 40 farmers on the use of CA and the use of hybrid seeds, which is another practice being encouraged by SIMLEZA-Africa RISING. He is planning to continue sharing knowledge gained from the project with others.

## Strategic management of natural resources: A watery perspective

A farmer examines his maize crop. Photo credit: CIAT/Stephanie Malyon.

Patrice looks at the maize growing on his farm. The stems are stunted, the cobs immature and the leaves are yellow. It will be another failed crop this year, a consequence of the rain coming too little too late.

The ground is parched and where a small stream used to flow through his farm – bringing its life-giving waters to thirsty crops – only a dry riverbed remains. As a result, the canals that used to take water from the stream around Patrice's farm are of service no more. With no rain or stream to water his maize, there is little he can do but watch his entire crop waste away.

This is the reality facing many farmers in parts of northern Tanzania, where failed rains and drying streams mean the main source of livelihood – agriculture – is under serious threat.

Though little can be done to influence the rains, something can be done about the drying streams to maintain them as a lifeline for farmers like Patrice who need a way to irrigate their crops in the dry season. It all starts with how water is managed as a strategic resource by the community.

In a bid to buffer smallholder farmers from erratic rainfall the International Center for Tropical Agriculture (CIAT), through the Africa RISING project, is carrying out research into sustainable water management and use in Tanzania.

CIAT scientist Fred Kizito (right) uses a Diviner 2000 device to measure soil water over multiple depths in Babati District, Tanzania. Photo credit: IITA/Jonathan Odhong'

Using a combination of scientific techniques, monitoring instruments and computer models, CIAT is investigating water dynamics in the region. Scientists are looking at everything, from how much and how often it rains, to the consumption of water by different crops, to water abstraction from the rivers for household and other uses. In doing so, CIAT is building a bigger picture of how water is utilized here.

This knowledge will enable the development of an optimized water use strategy that will safeguard against depleting the resource through agricultural wastage. The strategy includes identifying plants that suck too much water out of the ground and release it into the air through transpiration.

CIAT is already testing the consumptive water use of several varieties of crops and making recommendations for varieties that give the best yields with the least use of water. Initiatives such as these will ensure that the ever scarcer water resources are utilized efficiently and sustainably preventing their depletion and the consequent repercussions.

Researchers are also testing a range of other crop varieties in order to identify those that are resilient to the region's changing climate and delayed rains. Part of this research involves finding out how much moisture is in the soil at the deeper levels below the surface. This will help in the selection of suitable crop varieties to test in the region – those that have deeper roots and can reach deep-seated water and survive in dry seasons.

This research, and other initiatives, is being carried out in a bid to help farmers in northern Tanzania adapt to less water and unpredictable rains. Findings from this study will be used in other parts of Africa facing similar water stress.

## A new dawn in Zanzoni, Mali as natural resource management conventions are formalized

*The mayor of commune rurale Fakolo signing the local conventions for Zanzoni with village chief next to him. Photo credit: ILRI/Clarisse Umutoni.*

Bang, bang, bang!!!

The sound of the three gun salute rent the air as residents of Zanzoni village in southern Mali watched expectantly. The pin-drop silence that permeated the village square as the three traditional hunters shot skywards soon gave way to sounds of joy and celebration.

Tuesday 21 April, 2015 is a day the community will never forget. It is the day the residents of Zanzoni and their leaders formalized their oral non-formal rules of natural resource management into formal (written) local conventions for the community.

Since September 2013, through the Africa RISING project, the International Livestock Research Institute (ILRI) and L'Association Malienne d'Eveil au Développement Durable (AMEDD), a local Malian NGO, have worked with the community in Zanzoni to ensure that they have a more equitable and sustainable approach of managing natural resources in their mixed crop-livestock systems. Like in most sub-Saharan African countries, natural resources are the basis for the livelihoods of rural communities in Mali who depend almost exclusively on agriculture and livestock. Many factors, such as the rapid increase in human and livestock population have resulted in growing pressure and conflicts over natural resources.

While various efforts have previously been made to develop and formalize local conventions, multiplicity and the ambiguity on the legality of local conventions have slowed down effective implementation of decentralized management of natural resources. The participation of community members in the elaboration and implementation processes had also previously been weak despite their important role as custodians and users of the natural resources.

The journey from oral non-formal rules to formal local conventions for the management of natural resources in the community started with a study to document the existing local rules and norms by Clarisse Umutoni, an ILRI PhD fellow based at the ICRISAT office in Bamako, Mali. The study was conducted under the USAID-funded Africa RISING project in Mali.

> We found that most rules and norms governing natural resource use and management in Mali's communities were oral. The custodians of these local rules and norms were often the village elders and with passage of time, there is high risk the younger generations will forget them,' says Umutoni.

The concept of formalization of the local rules and norms has been promoted in Mali under an initiative of decentralization reform to empower communities to manage their resources. Together with AMEDD, ILRI supported the writing of the local conventions in Zanzoni, a relatively big village of more than 3,000 people.

AMEDD led the processes of writing down the local rules and norms with key community leaders after a series of meetings. The draft local rules and norms were then reviewed by a committee of elders in the village and a date - 21 April 2015 was set for validating the draft rules and norms by the whole community.

With the signature of the village chief and the mayor, the document will now be presented to the administrative head of Koutiala province ('cercle') for review and once approved, it becomes a legally binding set of rules for the community.

The village chief and various community leaders in Zanzoni praised the project for the achievement. 'This convention will help in reducing conflicts with pastoralists whom we share some of these natural resources with," said the chief at the end of the event. The success in Zanzoni has already spurred interest among leaders of neighboring villages who have approached AMEDD for similar interventions to be initiated in their villages.

## Barking up the right tree: Multipurpose trees help Tanzania smallholders build a resilient farming system

*Winnie Saigodi has planted Gliricidia sepium and Grevillea robusta trees as shelter belts in her farm. Photo credit: IITA/Jonathan Odhong'.*

Winnie Saigodi, a mother of five, from Moleti village in Kongwa District, Tanzania, had long given up on ever harvesting any meaningful produce from her one acre farm.

'Farmers 'I completely lost hope because for five years, I hardly harvested anything from the farm despite cultivating different crops. Nothing grew well and soil erosion was also a major problem,' Saigodi says. She eventually left the land fallow until researchers from the World Agroforesty Centre (ICRAF) working with the Africa RISING project visited her and asked to use part of her farm for research trials on growing multipurpose Gliricidia (*Gliricidia sepium*) trees, which can be grown for fodder, wood supply, wind erosion control and soil fertility improvement.

She readily accepted because she had nothing to lose. Two years after the research and demonstration trials started, her opinion about the productivity of her land has completely changed.

What she has seen has convinced her that she and other smallholder farmers in Tanzania's soil erosion battered districts of Kongwa and Kiteto can still get good harvests from their farms and turn around their fortunes.

Anthony Kimaro, the ICRAF country representative in Tanzania and the Africa RISING research theme leader, says that in the 2014/2015 season alone, courtesy of the project, over 16,000 Gliricidia seedlings were raised by farmers and distributed for planting in the five villages of Mlali, Molet, Ilakala, Manyusi and Njoro. More than 100 lead farmers took part in a demonstration of the tested agroforestry technologies of raising these trees and they later shared their newly acquired knowledge with other farmers.

'Farmers now know how to raise these tree seedlings and plant them in strategic parts of their fields depending on site condition and land availability,' explains Kimaro. Africa RISING is also establishing various landscape based agroforestry practices to improve access to fodder, fuel wood and to control soil erosion in Tanzania's Kongwa and Kiteto Districts.

Farmers will also use the Gliricidia as a source of firewood and green manure. Harvesting of crops residues as fodder (supplementary animal feeds) or fuel wood (for cooking) is already common practice in semi-arid central Tanzania where the project's activities are being implemented.

*Creating change: Farmers in Mlali village in Kongwa District, Tanzania are also planting Grevillea trees to supply fuel wood and timber. Photo credit: IITA/Jonathan Odhong'.*

According to Kimaro, fuel wood extraction is responsible for more than a quarter (27%) of all deforestation in Tanzania. Farmers, especially women, in semi-arid areas spend six to eight

hours each day searching for a head load of fuel wood which is used up after just two to three days.'

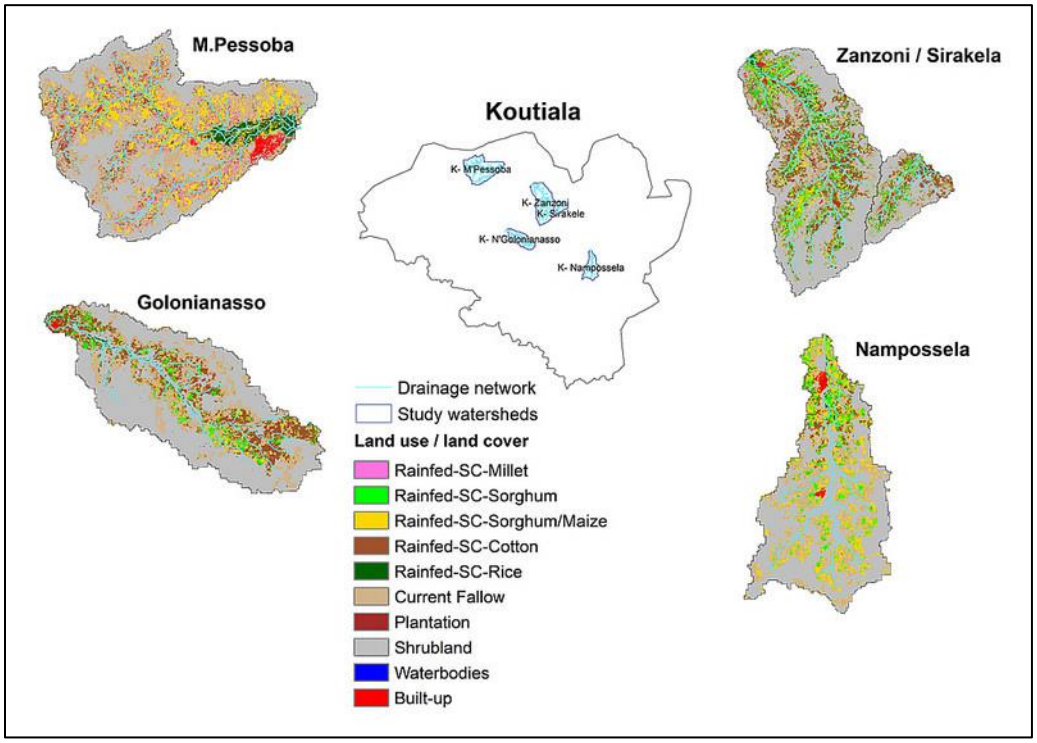
He believes fast growing leguminous trees/shrubs such as Gliricidia and Melia trees will help households build firewood reserves in addition to providing animal feed and green manure for their farms.

“I am happy that my field is green and I have started enjoying the shade from the trees during lunch or breastfeeding breaks when working in the farm,' says Saigodi. She is looking forward to harvesting a good amount of wood in December this year from the year-old Gliricidia trees, which is much more than she gets from crop residues.

She says knowledge from the project is changing the beliefs and misconceptions of farmers in the village.

'We believed trees couldn't be planted in the farms because they suck away nutrients from food crops, but we now know the types of trees that are friendly to crops and that add nutrients in the soil,' she says. 'Moreover, planting trees at the farm is helping reduce farm boundary conflicts.'

## New Africa RISING geospatial maps show cropping patterns and land use changes in Mali

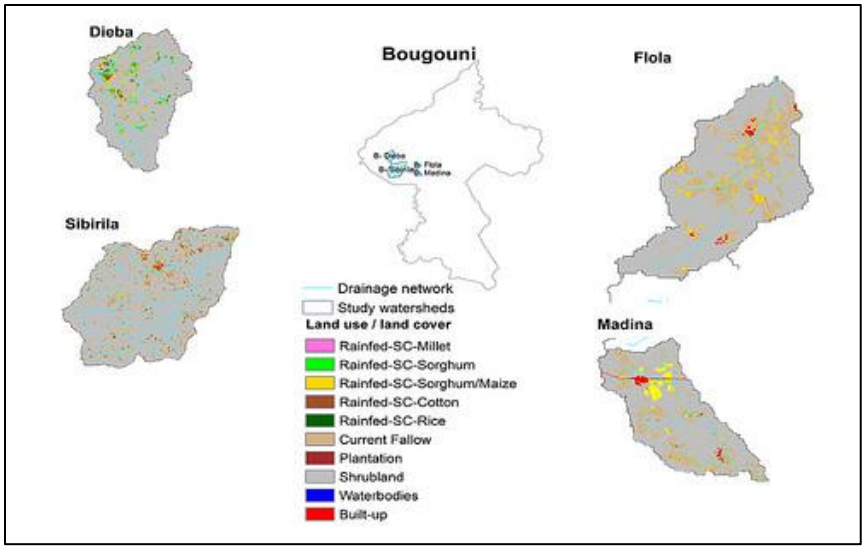



*High resolution land use map for Koutiala Cercle in southern Mali. Photo credit: Africa RISING*

Africa RISING and the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) geospatial unit in Patancheru, India, have developed land use maps of Africa RISING project intervention sites in southern Mali.

The new maps, which were produced in mid-August 2015, will ease the process of identifying and visualizing different crop domains and possible natural resource management (NRM) sites within the Africa RISING intervention villages in Mali. The maps were produced using high resolution imagery from NASA and the National Oceanic and Atmospheric Administration (NOAA).

'These maps will help us know the areas to focus our sustainable intensification efforts in Mali; they will also guide preparation of country strategies for sustainable primary productivity,' explains Birhanu Zemadim. 'We will use the ground survey data they provide to prepare geospatial products associated with land use/land cover, crop intensity, length of growing periods, land use changes over the period and NRM technologies.' he adds.



*High resolution land use map for Bougouni Cercle in southern Mali. Photo credit: Africa RISING.*

Satellite-based mapping of major cropping systems requires verification of crop information on the field. The team that prepared the maps, which was led by Murali Gumma, Birhanu Zemadim and Cedrick Guedessou, traveled to all the intervention villages by road to cover most of the land use/land cover types and locate the validation sites. They also conducted farmer interviews to understand the local practices and information on cropping intensity and water availability.

The mapping work in southern Mali started in March 2015.

Geospatial products, such as these maps, will help agriculture researchers in the Africa RISING project in identifying major crop domains, intensities, and priority sites for natural resources management interventions.

# Knowledge is power: BUSTING SOIL MYTHS IN TANZANIA

https://slate.adobe.com/a/Bxvpy/

Farmers know that soil is a precious commodity. But in Babati district, northern Tanzania, a long held belief that mineral fertiliser spoils soils is preventing them from making informed decisions on how best to keep their soil healthy and increase their yields. Researchers from the International Center for Tropical Agriculture (CIAT) and the Selian Agriculture Research Institute (SARI) are investigating best-bet fertiliser options and agronomic practices for maize in the region as part of the USAID-funded Africa RISING. Their work is challenging local beliefs and changing attitudes.

Maize is one of the most important crops for food security and livelihoods in Tanzania. Yet, while many farmers grow improved varieties, yields are far lower than their potential. Most farmers don't use mineral fertiliser and those that do don't apply enough to make an impact. More farmers use organic fertiliser such as manure but supplies are limited.

Wema Ako, a farmer from Long, a small village in the peaks of the East African Rift Valley Highlands, was brought up to believe mineral fertiliser is bad. He doesn't know where the belief came from but his father, from whom Wema inherited land, refused to use industrial fertiliser.

In fact, the belief is so old that only older generations remember how it started. Gabriel Leonse (59) from Seloto village remembers a visit from an extension worker more than 40 years ago.

"In 1974 an expert came to tell us about field management and fertiliser. They brought ammonium sulphate and taught us to apply it around the plant stem," Gabriel recalls. "It burnt the leaves and the following season the harvest was lower than before it was applied. After that, many believed fertiliser was bad for the soil. The extension worker never came back".

Soil science and fertilisers have come a long way since 1974. Today, after carrying out soil tests, researchers know that ammonium sulphate is not appropriate for soils in Babati because it increases soil acidity. Yet it remains the recommended fertiliser for the entire country.

"It's not surprising farmers here don't use fertiliser. The type of fertiliser and application method recommended were incorrect. And since no one ever returned to give them new and better advice, they don't know the options available or if they can afford it," says CIAT soil scientist Isaac Savini.

Two years ago Isaac, along with partners from SARI, started working with farmers in Babati to test the suitability of different fertilisers on maize crops. It was the first time anyone had advised farmers about fertiliser since 1974. The aim of the Africa RISING project is to discover optimal - and affordable - organic and mineral fertilizer combinations coupled with the most suitable maize varieties and most appropriate agronomic practices.

Each season a group of volunteer farmers agree to use different fertiliser combinations on a section of their land. And at each harvest Isaac returns to collect samples for comparison.

He tests the soil and the weight, number of cobs and biomass of the maize.
ss of the maize. "At first it wasn't easy to find farmers who were willing to work with us," said Isaac. "But now they have seen the results of the trials we are turning farmers away."

Rita Matias was nominated by her community to take part in the research. "I've always used manure to fertilise my soil but I had to rotate it because there was never enough to go round," said Rita. "I never used mineral fertiliser because I didn't have any knowledge about it."

Since she has been using mineral fertiliser, Rita has noticed a big difference in her yields and has increased her income by 50 per cent or more, depending on the market. "It is more work to use fertiliser," said Rita, referring to weeding, correct spacing, pest and disease control and other agronomic practices needed to get the best out of her investment. "But it's worth it."

Rita is now training others on how to use fertiliser. "Neighbours see my field and ask me about it. By teaching others we are reducing the numbers of people who think it is bad for the soil. Now they can use it correctly."

Wema is also taking part in the trials. At harvest time it's easy to see which crop was fertilised and which wasn't. The cobs from fertilised plants are double the size of those that weren't. The most promising combination of organic and mineral fertiliser is producing on-farm yields of up to six tons of maize grain per hectare. The regional average is less than one ton per hectare

Despite the presence of researchers and the results of the trials, some farmers are still not convinced. Joseph Teodule (79) states he will never use industrial fertilisers. "I know fertiliser could give me higher yields but from my heart, I am not willing," said Joseph.

"But at least," says Isaac, "he is now making that decision from a position of knowledge. That is what we want."

Education is only the first step in enabling farmers to make informed decisions about fertiliser. Isaac is working with Corneleus Yangole, a researcher from SARI. "Once we have assessed the performance of each option we will carry out an economic analysis so that our final recommendations are based on the best and most financially affordable options," said Corneleus."We can make all the recommendations we want, but if they are beyond a farmer's financial means they are useless."

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Researchers have one more season of trials to go before they make their final analysis. SARI will use the recommendations to work with agro dealers to ensure suitable maize varieties and inputs are available locally, as well as work with government to support farmer friendly policies.

The recommendations will also be shared with farmers through SARI extension workers. "Today extension is in it for the long haul," Corneleus added.

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) programme is part of the U.S. governments Feed the Future initiative, which is split into three regional projects. Research conducted by CIAT and SARI is part of the Sustainable Intensification of Key Farming Systems in East and Southern Africa project led by the International Institute of Tropical Agriculture (IITA). The UN has declared 2015 as the International Year of Soils to raise awareness of the urgent need to protect the hand that feeds and waters us - our soils. Find out how CIAT's global soils team of scientists, ecologists and anthropologists are working to protect this vital resource.

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